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The MODEL ENGINEER

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1ST SEPTEMBER 1949 VOL. 101 NO. 2519

SMOKE RINGS

"M.E." Exhibition Observations

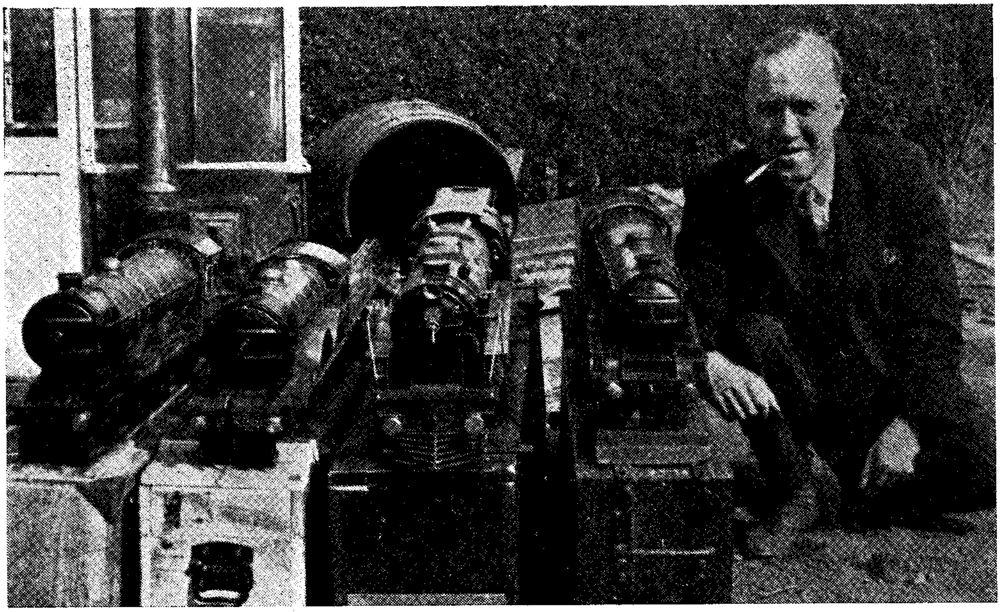
● THE EIGHT pages in the centre of this issue are devoted to notes and pictures which will give our readers an idea of some more of the good things that were on view. We hope later on to publish some considered comments to show where some model makers have gone astray, and to help in the prevention of errors in the future. In the meantime, our readers may care to amuse themselves by studying the photographs we have published, so far, and trying to discover the mistakes. We do not expect that *all* our readers visited the show, if only because it did not last long enough to permit that; but we can ensure that every reader is provided with picture and story to enable him, or her, to visualise some of the excellent models displayed.

Editorial Limitations!

● THE INABILITY to be in several places at once is a great handicap to our Editorial staff at the time of the Exhibition. All day and every day, their multifarious duties take them backwards and forwards from the office to the Horticultural Hall—and they rarely manage to be in the right place at the right time. In the midst of judging or reporting, comes an urgent call from the office—the printer is screaming to be fed—last-minute proofs to be read—or a photograph urgently needed to fill specially-arranged space has not been delivered. Back hot-foot to the office, only to find that in the meanwhile a call has come through from the Hall that a visitor has arrived who must be interviewed immediately. But life has its compensations, even for Editors; there is a very real satisfaction in finding, from evidence provided by many of the exhibits which make their appearance year by year, that one's efforts to provide readers with sound information on the construction of models is bearing good fruit. The many meetings with readers from far and wide, and greetings from both old and new friends, are no less gratifying. Despite the enormous amount of work that falls to the lot of the Editors during the Exhibition, the time passes all too quickly, leaving still more hard work in its aftermath, but providing new strength and inspiration for another year of progress. One is sometimes glad that the Exhibition, like Christmas, comes but once a year—but we would not miss it for anything in the world!

The Man and His Work

● THE PHOTOGRAPH reproduced on this page depicts a well-known personality, Mr. Tom Lawson, erstwhile Chairman of the Nottingham Society of Model Engineers, who is now, after some years of overseas service during the war, and subsequent rehabilitation in civil life, domiciled in a town with a familiar name—Philadelphia. But it is in County Durham, not the U.S.A.



With him, are seen his $3\frac{1}{2}$-in. gauge locomotives; from left to right, these are: A North Eastern Atlantic; a North Eastern "R1" 4-4-0 ("Miss Ten-to-Eight"); a German "Henschell" 2-10-2, and a London and North Eastern Gresley Pacific. They all exemplify a high standard of workmanship and are much admired whenever they are exhibited at model engineering functions.

Our Cover Picture

● ALTHOUGH THE model car now ranks among the most popular types of competition model, and has attained a remarkable standard of efficiency in the course of a few years evolution, it is still rare to encounter a complete representative model of a motor vehicle with all detail fittings, including a working model i.c. engine of a type comparable with that of the full-sized vehicle. The model shown in this photograph is probably unique in this respect, and apart from its fidelity as a model, it is also remarkable for its working efficiency and reliability. It was built by Mr. L. O. Gibbs, of Addiscombe, Surrey, who is also seen in the picture, and is fitted with a 40-c.c. four-cylinder side-valve engine, with automatic carburettor and coil ignition. Transmission is by means of a four-speed gearbox and a single dry-plate clutch actuated through a bowden wire from a finger control on the gear lever. Cooling is by a scale radiator with fifty $\frac{1}{8}$-in. copper tubes, with the usual belt-driven fan and centrifugal circulating pump. The chassis is modelled on the Bedford "Mechanical Horse" to a scale of 1 : 5, the type being largely dictated by the type and size of tyres available, which are 7-in. Dunlop "Trak-grip." Full Ackerman steering gear is fitted to the front axle, operated through worm gearing, with ball joints and adjustable track rod. The rear axle has full floating half-shafts and full bevel differential gear; brake drums and detachable rims are fitted to the wheels, and laminated springs made from spring-steel strip $\frac{9}{16}$ in. wide, with working shackles, are fitted. The model will carry the constructor at a speed of 12 m.p.h. and will haul two passengers at lower speeds, on a self-supporting trolley so designed that the weight of the driver is not taken by the chassis springs; it has good flexibility of control, climbing and starting from rest being in conformity with prototype performance.

High Wycombe Society's Secretary

● THE High Wycombe and District Model Engineering Society has lost the services of its genial hon. secretary, Mr. E. J. Szlumper, who has left the district. We know him well as a most excellent secretary whose cheery presence will be missed by all who were in contact with him. His successor is Mr. H. A. Gibbs, whom we are also pleased to have met and we wish him many pleasant years in his new duties. His address is 159, Gordon Road, High Wycombe, Bucks.

Constructing a $7\frac{1}{2}$-in. Gauge "Midge"

by W. J. White, A.M.I.E.E. (Dunedin, N.Z.)

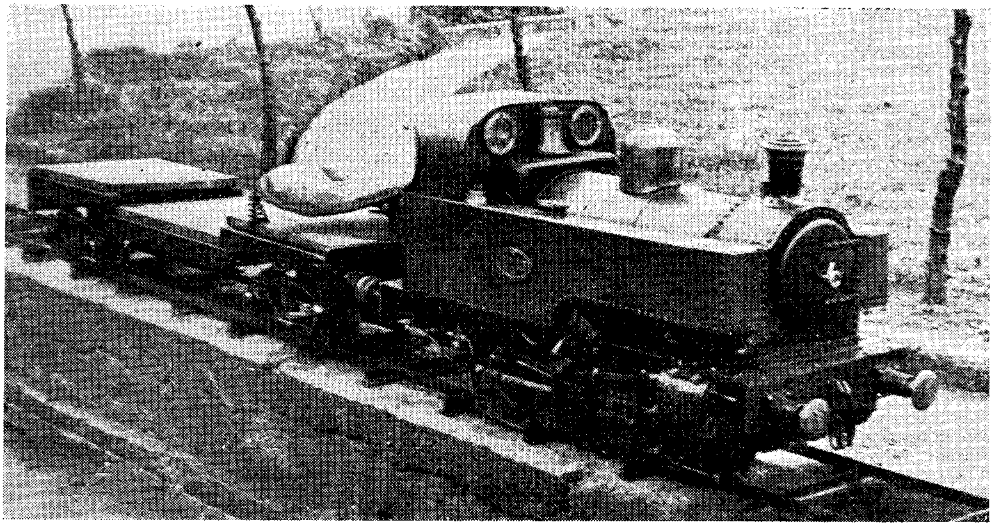
SINCE the completion of my traction engine, *vide* note in the MODEL ENGINEER July 25th, 1940, I have finished a "Midge" $7\frac{1}{2}$-in. gauge locomotive to the general details published.

The chief departures from the original design were due to necessity, suitable material being very difficult to secure out here, e.g., I had even to pinch my wife's front doorplate to obtain sheet brass for side tanks. The lady, however, demanded and got a stainless metal substitute. The nameplate 4/2215 is my old war meat ticket number which was on service with me in the N.Z. Engineers in Mesopotamia.

After struggling with numerous patterns, using oak and elm (the latter ex-old mangle rollers), I started on the frames which are heavy, $\frac{1}{4}$-in. mild-steel plate. Hacksawing and drilling was the order of the day here.

The horn slots were trued *in situ* on a "steptoe" shaper through the assistance of L. Boyce, a fellow conspirator. Incidentally, he and I were primarily responsible for the foundation of the Otago Model Club of which I hold the first issued membership ticket No. 1.

A length of 16 in. of $5\frac{1}{2}$ in. diameter S.D. copper tube was available for the boiler. Happening to possess this at the time the "Midge" articles appeared, I could not resist the temptation and, temporarily abandoning the traction engine which still requires larger pumps, although it performed well on a preliminary test at the Club, I commenced copper-smithing. Innumerable copper rivets had to be made with usual dowel-plates, frequent plate annealings in the kitchen fire using C.I. formers, and sticking religiously to a wood mallet throughout, I got the tube plates and Belpaire sections made without perceptible marks.



Note the motor-cycle seat for driver on truck

Assembly

A solo effort, required the use of both hands, one knee and an old lathe-belt over the rafter. Balancing on the remaining leg, steadying the boiler on the stake, then snapping rivet heads, can be classified as a distinct phase of engineering. The whole is fully stayed and nutted as per specification. After riveting I then welded the assembly with a hired oxy-acetylene plant using mainly 500 jet and cuprotechtic rod.

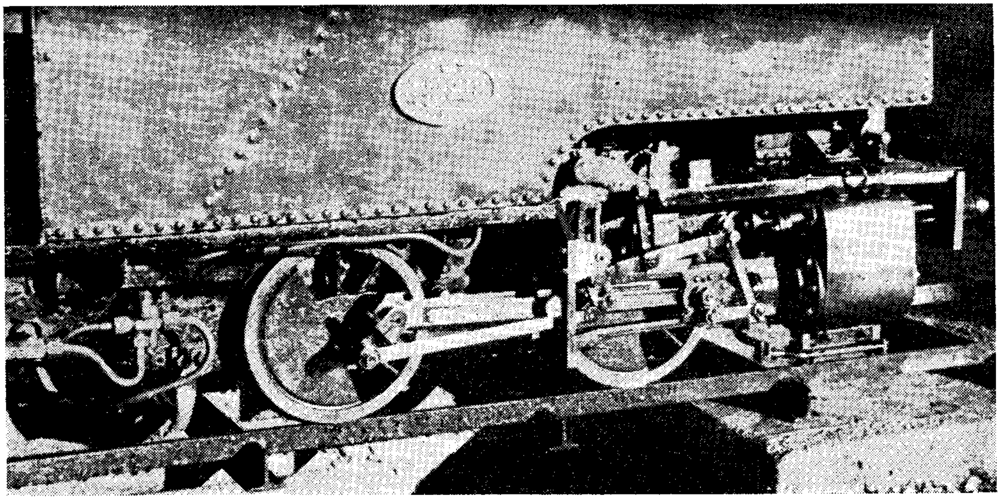
Actually, the $5\frac{1}{2}$ in. shell was undersize, so I altered the design to an additional $1\frac{1}{2}$ in. long and put in sixteen $\frac{1}{2}$ in. tubes. She is tested to 250 lb. water and steams at 100 lb. With an auxiliary blower jet in the smokebox on 20 lb. air with one charge of wood firing, she picks up her own steam blower in ten minutes; another ten minutes see the gauge at 100 and blow off. I can recommend this smokebox air jet as it dispenses with the usual telescopic funnels.

The throatplate barrel flange was made by pulling an old cannon-ball through. This had a central hole through which a tightening bolt was passed. Technically, a kind of drift, but it was followed up by judicious wood malleting. I never attempt to use a steel hammer on copper.

As I could not get Bond's original cylinders, the war being on, I had to adapt the general-purpose design, *vide* MODEL ENGINEER, Gentry & Willoughby. I think this will be one of the first instances such has been used in the "Midge." This design has a circular valve-face and inclined cover joint. The ports in this valve-face to "Midge" dimensions were cut with a 3-gauge cutter, with spacers in width equivalent to the specified port bar.

This particular design of cylinder gives a great

and after some experiment having the oscillating cylinder flat port face type of oil-pump as "L.B.S.C." advocates (incidentally, I am using one of these in the traction engine), I put in a double-cylinder trunnion-controlled type in a box between frames and ratcheted off an axle eccentric as an auxiliary. You will see this type in the Willans and other H.S. steam S.A. engine usually totally submerged in the crank-case. With 600 oil it works well and will blow one's finger off the cylinder nipple.



The valve motion of Mr. White's "Midge"

runaway to the exhaust which thus encounters only one pipe bend before emerging from the blast, with some spectacular results—particularly when starting under load. You can almost pass a threepenny piece out of the exhaust port and through the breeches-pipe. Pistons have one ring made of special square-section $\frac{1}{4}$ in. × $\frac{1}{4}$ in. steam packing, Garlock Brand, which I think far surpasses the metal ring and is advocated by Mr. Pinney, a contemporary in Taranaki here.

She is, as the designer stated, a wet engine, and it is imperative that suitable drains be fitted. This I found when she primed badly at starting. I had a lot of trouble with these drains—made four types and finally adopted a device pressing a ball upwards against the seat with lever-operated low-pitch screw, something resembling a gun-breech, fine adjustment screw through centre. This job left little room between drains and rail level, there being only $\frac{3}{4}$ in. to work in.

Ring Blower

Due to its liability to block, I abandoned this in favour of single-jet type. These and blast jets were the subject of some experiment.

The valve-motion was set by a professional, and she "chops off" the exhaust smoke in a consecutive series of loops, virtually a half-sine wave.

Lubrication

One plunger type spring return displacement

There is a snifter connected to the steam header and showing behind the funnel. The regulator, in dome, is stainless steel and bronze two-link combination.

Fittings at footplate include reverse lever, water-gauge, two separate trycocks, steam gauge, blower and whistle-valves, drains lever. One mechanical $\frac{1}{2}$ in. × $\frac{1}{2}$ in. boiler pump (which is too small, I think), one 2-cylinder vertical, $\frac{3}{4}$ in. bore hand rocker pump, the third tried out; injector (overseas make), dribbles slightly; two backhead clacks, one for pumps and other for injector. The plumbing is involved, the two tanks piped to a common filter behind rear buffer-beams. This acts as equalizer pipe; from here three pipes—one to hand, one to mechanical pump, one to injector; pump outputs combined to a bypass, thence to the L.H. clack. The injector is separately piped to the R.H. clack.

The Walschaerts motion was carved from the solid, chiefly from black m.s. bar; sides and con-rods fluted, all polish-finish—as Gilpatric's hero Glencannon said—mostly "wi' a file." Have made two double-bogie diamond-frame steel trucks to MODEL ENGINEER design—they weigh 120 lb. each—with ball-races on journals; with a 12-stone passenger on one, a circular-scale balance fixed to the rear end, shows 75 lb. drawbar-pull.

(*Continued on page* 276)

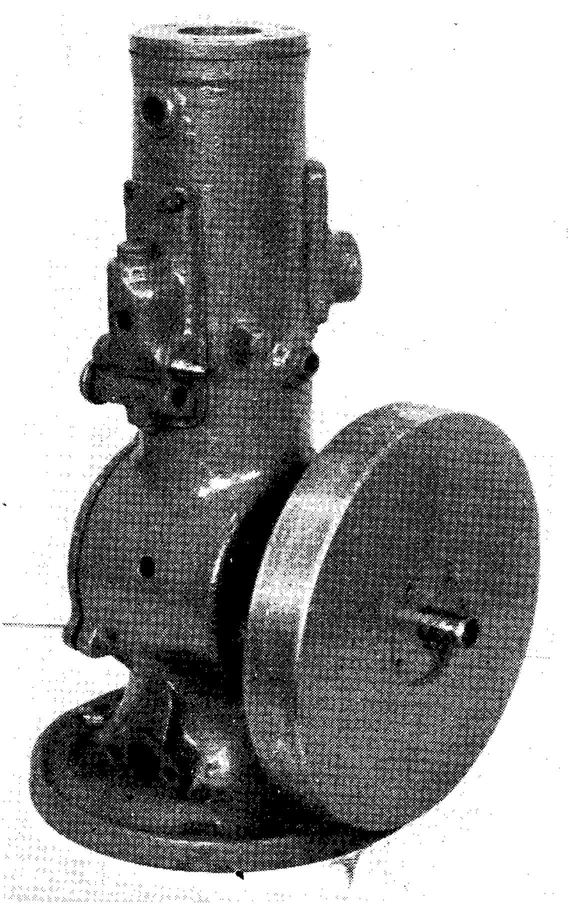
PETROL ENGINE TOPICS

A Curious Old Gas Engine

by Edgar T. Westbury

THERE are no doubt many readers who, like myself, find a great deal of interest in studying unusual mechanisms of all kinds. This is as it should be, because the underlying motive behind nearly all model engineering is a love of mechanism for its own sake, apart from what duty it performs, or its ultimate utility. One of the reasons why we admire the engines of a past age is because, no matter how crude and inefficient they were according to modern standards, they evince ingenuity of conception and individuality of thought such as is only too rarely encountered in the present austerely utilitarian age.

In the field of internal combustion engines, one sees few attempts nowadays to break away from well-established principles of design, and despite their diversity of form, engines for various purposes have much the same basic mechanical design. The efficiency expert will say that this is because these salient features have been proved by experience to be the best for their practical purpose, and that there has been a weeding-out of principles and features which, however ingenious, have not stood the test in the hard school of everyday utility. While it is probable that this view would be generally endorsed by engineers, it is by no means a foregone conclusion which should be accepted without further examination. It is not unreasonable to believe that some of the ingenious forms of design which have been tried in the past—and at the time, been found wanting — might, if properly developed, have been just as successful and efficient as those which have now become an integral part of orthodox or conventional practice.



The rotary-piston gas engine, showing gas mixing valve on left side of cylinder and exhaust port on the right. The port in base of crankcase leads to a recess which might have been used as an exhaust silencer

Many examples could be cited where an old idea, which at the time of its inception was unsuccessful, generally because of limitations in metallurgy or methods of machining then available, has been revived and has proved to be the answer to a modern problem. Indeed, one may say that few of the mechanical ideas incorporated in the latest machines are themselves new in conception ; more often they are, like most of the jokes of radio comedians, minor variations on very old themes. True ingenuity, based on sound principles of physical and mechanical science, is never ultimately wasted, and though the original author of a bright idea may never reap the reward of his ingenuity, it is fairly certain that someone eventually will.

From time to time, readers of the MODEL ENGINEER who unearth rare specimens of old mechanism ask me to identify them, or to advise them regarding their origin, purpose and history. These specimens range from complete machines to mere fragments—I am sometimes called upon to perform a feat of reconstruction equal to that

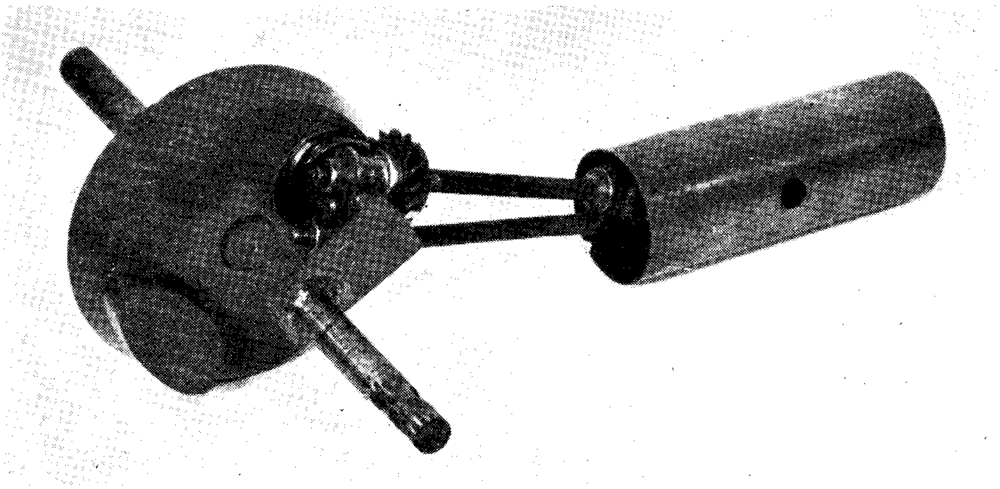
of the palaeontologist who gives a detailed description of a dinosaur on the strength of evidence provided by a single bone—but in nearly all cases they exhibit the ingenuity of a dead and forgotten inventor. What matters is that the ingenuity may have been misguided or misplaced? It is all of intense interest to the engineering enthusiast, and represents some phase of the eternal wrestle with mechanical problems which occurs all along the path of progress.

This preamble constitutes my excuse—if excuse be needed—for introducing to readers the description of an engine which is far removed from the type of thing usually in the minds of model i.c. engine enthusiasts—and perhaps some of my readers will find it, for that very reason, a refreshing change. It will, at any rate, remind them that there are other possible types of engines than those which are predominant—often to the point of monotony—in the model engineering world today.

Some time ago, an engine of an unusual type was brought to my notice by Mr. Hammond, of Clerkenwell, who had acquired the engine in the course of his business as a dealer in second-hand machinery, and had been trying, without success, to trace the maker or inventor. In this latter respect, I have so far been unable to give him much assistance, but the description he gave of the engine aroused my curiosity, and after a preliminary inspection, it was loaned to me for a closer and more detailed examination.

Two-stroke or Four-stroke?

From a cursory inspection of the outside of the engine, one might easily jump to the conclusion that it was a two-stroke "valveless" engine of a very archaic type, as it has no exterior evidence of any valve mechanism, and the position of the exhaust and inlet ports on the cylinder barrel is more or less in keeping with this idea. Some of the early two-stroke engines, built for marine or stationary purposes, had a long stroke in relation to their bore, besides a much longer piston and connecting rod, and a smaller annular water jacket space, than is common in modern practice, producing the lean, spindly appearance characteristic of the "genuine antique" in engines of this class. But even after stripping the engine, and revealing its highly ingenious valve timing gear, one might still conclude that it was a two-stroke of an elaborate type, in which an attempt had been made to improve upon the port timing by the incorporation of mechanical timing gear.



Crankshaft, connecting-rod and piston assembly, showing scroll gear on crank disc and skew gear on rotary shaft of connecting-rod

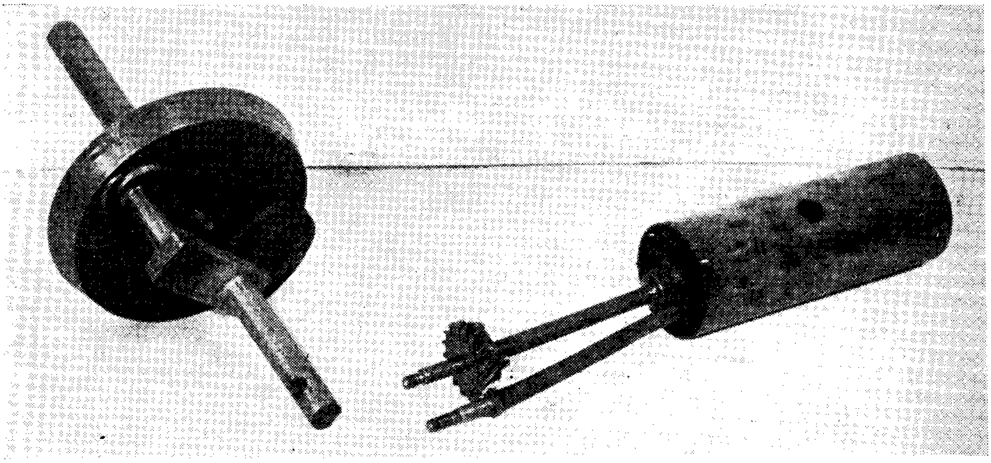
It may be mentioned, for the benefit of those readers who have not studied the history and evolution of i.c. engine design, that there have been many such attempts, particularly in the early days of the two-stroke engine, when this particular type was a happy hunting-ground for many inventors. Almost every known type of valve and method of operation has been exploited in innumerable patents for improved two-stroke engines, few of which ever reached the production stage, and still less survived for any length of time. The reason why these inventions "missed the boat" was that they sought to remedy the glaringly obvious limitations and faults of the simple engine, without taking into account its practical virtues of mechanical efficiency, freedom from trouble, and low initial cost, which are often more important from the utility point of view than obtaining the utmost economy or power output. Very often the gain in efficiency produced by considerable elaboration is more theoretical than actual, being more than offset by mechanical losses in the valve operating mechanism. But perhaps I am guilty of digression, so we will leave this diverting subject and "return to our muttons," as they say in France.

The engine is, in actual fact, a four-stroke, the valve events being controlled by a rotary piston-

cum-sleeve-valve, operated by means of a skew gear attached to the connecting-rod, and meshing with a "face worm" or scroll gear on the face of the crank disc, concentric with the crankpin. It may be mentioned in passing that this form of valve although unusual, is by no means unique in i.c. engine practice. About thirty years ago, considerable publicity was given to an American engine which had a rotating piston, so designed as to act as a sleeve valve; but it proved to be a nine-days' wonder, and was never a commercial success. The use of a rotary sleeve valve surrounding a more normal type of piston, and operated by spur and worm gearing from the crankshaft, was somewhat more successful, and I remember working on an electric generating plant, also of American manufacture, and known as the "Silent Alamo," in which such an engine was employed.

But the engine now under discussion almost certainly pre-dated these examples by many years, and I should estimate that it was the earliest engine having such a valve gear that I have ever encountered, either on paper or "in the flesh." Moreover, it lacks nothing in ingenuity; the type of gearing, and the use of a connecting-rod consisting of two bars, one of which forms the shaft of the skew gear, being probably unique. The piston is in the form of a long sleeve—actually twice the length of the stroke—with a partition in the centre, forming what would normally be the "crown." No piston rings are fitted, and it has two diametrically-opposed round ports above the partition, which each uncover inlet and exhaust ports in the cylinder wall, the speed of rotation of the piston being one-fourth that of the crankshaft. A rather elaborate form of universal joint, comprising a ball and socket in conjunction with a pin and die blocks, is used to transmit rotary motion from the skew gear shaft to the piston.

It will be noted that the upper part of the piston forms the combustion chamber, and in order to enable sufficient compression to be obtained, the detachable cylinder-head is made with a spigot or "junk head," 2½ in. in length, which passes down inside the piston sleeve. A tapped hole is provided in the centre of the spigot, presumably to take a sparking plug, the body of which is sunk into the spigot, so that it does not need to have an abnormally long reach. No ignition equipment was fitted to the engine at the time it came to my notice, but there was a small sprocket on the shaft, behind the flywheel, which might have been fitted, either originally or subsequently, for driving a magneto.



Crankshaft detached from piston and rod assembly

The engine has a bore of 2¼ in. and a stroke of 3 in. Its overall height is 17¼ in., and the flywheel is 10 in. diameter by 1½ in. face width. The body of the engine is a single casting, including the cylinder barrel and water-jacket, and a broad circular flange 10 in. diameter, on the underside, which forms the mounting pedestal. A rather unusual form of crankshaft construction is adopted, incorporating a main journal with a large cast-iron disc, apparently riveted on, forming both a balance weight and an internal flywheel. The crankpin, outer web and journal appear to be in one piece, riveted into the disc, and the scroll gear appears to be either cast or machined integrally with the disc. As the crankshaft assembly was badly bent, no attempt has been made to put the engine into working order so as to enable a running test to be carried out.

As the engine was intended to run on gas, no carburettor is fitted, but a somewhat elaborate (though not very scientific) gas mixing valve is provided in its place. This incorporates a screw-down valve which presumably controlled the admission of air, and a small mushroom valve, presumably for gas, with a long stem extending through a guide bush, and possibly intended to be controlled externally, either by hand or some form of governor, though there is no sign of the latter having been fitted.

A rather interesting feature about the gas mixing valve—and one that gives some clue to the period of the engine construction—is that no

proper provision is made for its attachment to the cylinder wall, such as by a machined flange or facing. It has a curved saddle piece which was presumably filed as truly as possible, likewise the circular face of the cylinder wall to which it was bolted, though no very high degree of precision appears to have been achieved, and even with a thick packing gasket, it must have been difficult to avoid leakage at the joint. Such methods of attachment were not uncommon in early engineering practice, before the machining facilities of the modern engineering works were generally available. It can hardly be that the need for an attachment at this point was overlooked in the design, in view of the care taken over other details; but one cannot imagine that any modern designer would have neglected to provide some machinable facing for so important a component as a gas mixer or carburettor.

I have already given some reasons—or excuses, if you prefer—for bringing this engine to the notice of readers. One of my critics has recently accused me of going to too much pains to "justify my opinions," or my reasons for doing things, but I think that most of my readers share my passion for finding out the why and wherefore of everything, and are not contented with knowing bare superficial facts. It is this spirit of investigation which is responsible for all human progress, not only in engineering, but in all other fields of thought. We were often told in our youth (by adults who didn't wish to go to the trouble of answering our innumerable questions) that "Curiosity killed the Cat"—but I feel sure that every one of its nine lives must have been well spent! (By the way, I have always wanted to know what cat?—and how was it killed, and why?—and more important still, what was it trying to find out?)

It is possible that other readers may have encountered the type of engine described, and may be able to give some further details, concerning its origin; if so, I should be glad to hear from them, and to pass on to readers any further information thus obtained. To those who are not so much interested in the historical side of research, there are still object lessons in this and many other ingenious types of old engines, which even the most ultra-modern engineers cannot afford to disregard. An engine of the type described, if redesigned and brought fully up to date in the light of modern experience, would certainly work quite well, and might even prove to have practical advantages over the conventional form of design. It could be made lighter than the ordinary four-stroke engine, and with adequate porting, and precision fitting of the piston sleeve, could be made to produce a high cylinder efficiency with the minimum mechanical losses. The principle is also adaptable with equal facility to two-stroke engines, enabling more efficient port timing to be attained, with the ability to delay the closure of the transfer port, a feature so desirable yet quite unattainable in the present form of two-stroke. The use of the piston as a valve has many mechanical advantages over any other form of valve gear, provided one can make it do exactly what is required. In sleeve valve design, it is generally accepted that the combination of rotary and reciprocating motion results in a reduction of friction as compared with straight-line motion, and this feature is found in most modern sleeve-valve engines.

Model engineers are notoriously assiduous in their search for the buried treasures of the junk yards. Let us not forget the possibilities of the junk yards and lumber rooms of history, from whose dusty recesses may often be gleaned a long-forgotten gem, all the more valuable for its antiquity and sentimental value; why, who knows?—it may even prove to be a genuine "old master," the value and interest of which has been enhanced a hundredfold by its long seclusion. Old text-books and catalogues, too, are prolific hunting-grounds for the mechanical enthusiast, and will often yield rich and rare specimens of the art and craft of a past engineering epoch.

I take this opportunity of thanking Mr. Hammond for bringing this engine to my notice, and giving me facilities for dismantling and examining it in detail.

Constructing a $7\frac{1}{2}$-in. Gauge "Midge"

(*Continued from page* 272)

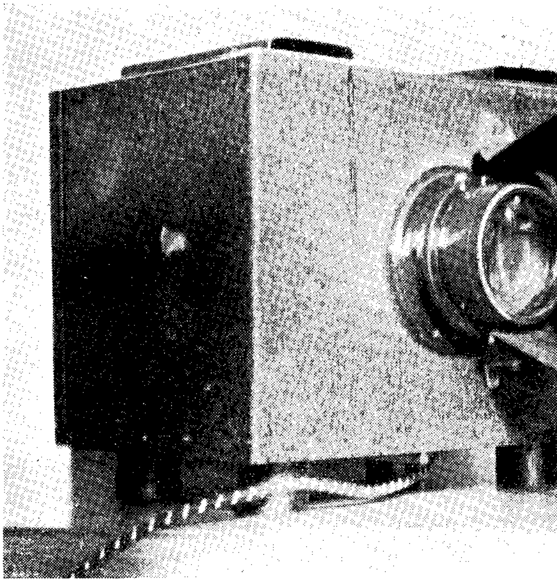
The engine will romp along with the two trucks loaded to capacity and was, when secretly tried out by the Hon. Club President, reported to have pulled ten adults on all the assorted gauge rolling stock they could find on the 400 ft. multiple gauge. I think she could do much better, however, with sufficient trucks and properly run in. Some weeks ago, she ran continuously for four hours, pulling youngsters on the Club track, on the occasion of their recent successful exhibition. P. Ingle, who is a good driver, then ran her. I may say that I have tried her, once or twice, but am not game to open her out past 1/3rd throttle. She notches up well; brakes not yet fitted to trucks or engine and no terminal backstops on tracks.

In running order the engine must weigh the best part of 2 cwt. The adhesion is terrific. I am thinking of fixing up a crane to handle her.

Actually, the gauge of the layout is $7\frac{1}{2}$ in. My authority for this departure from size is the adjunct railway to the Romney Hythe and Dymchurch, *vide* MODEL ENGINEER notes some time ago.

The track shown in the photo is a portion of 200 feet oval layout comprising $\frac{3}{4}$ in. × $\frac{1}{4}$ in. strip set in slots, gang-milled in 11 in. tee-iron sleepers at 9 in. spacing, then electric welded.

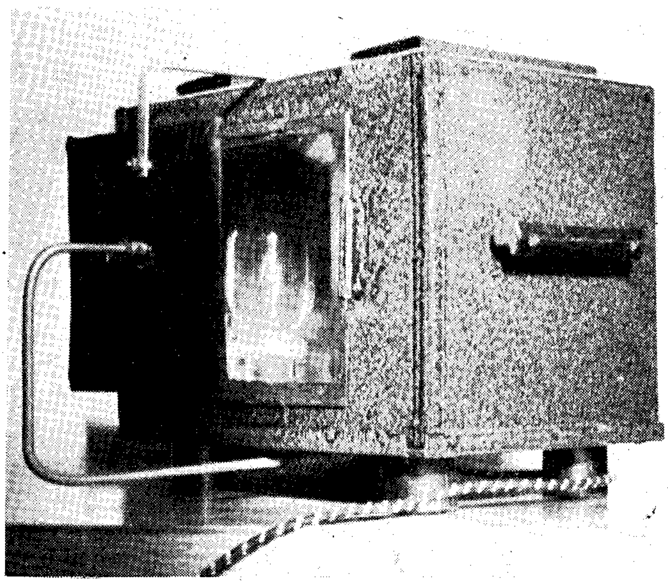
A Completed "M.E." Episcope



THE episcope illustrated on this page was built in accordance with the design by F. Mitchell, published in THE MODEL ENGINEER of June 24th, 1948, with one or two slight modifications. The original dimensions, 12 in. × 8 in. × 8 in. were adhered to, but as experiments proved that the f2.9 Dallmeyer lens used would amply cover a 6 in. × 6 in. picture, the picture aperture was increased to this size. The box was constructed of sheet aluminium, and angle duralumin bolted together with 8 B.A. nuts and bolts. A baffle was fitted between the lens and projection lamp to prevent surface reflection, and light concentration was improved by fitting a 6 in. × 6 in. metal mirror directly behind the projection lamp.

The episcope as described had no correction for lateral reversal, that is, any writing or printing on the picture appeared back to front on the screen. This was corrected by a mirror fixed at an angle of 45 deg. in front of the lens. The mirror used is an ex-R.A.F. type, complete with camera mounting, but it is just a little too small for the lens. A detachable 6 in. × 6 in. mirror would be ideal, making the projector a more convenient shape for carrying.

In commercial episcopes, the picture size/screen distance ratio can be varied by moving the lens towards or away from the picture; but the lens in this case is fixed. As I wished to project various sized pictures on to white paper, to be traced and subsequently painted for school use some method of adjustment had to be found After experimenting fruitlessly with the lens mounting, I hit on the idea of moving the picture instead. This was arranged by fitting an adjustable bracket to the top of the episcope, releasing the pressure-pad spring, and fixing the pad to the bracket. When the picture or sketch is fixed to the pad, the whole thing can be adjusted to give the size of picture desired at any distance. Obviously, a certain amount of light escapes through the open back, but as I am only interested from the copying point of view, the light loss is not important. This could be easily cured, if necessary, by fitting bellows, similar to those on a folding camera.

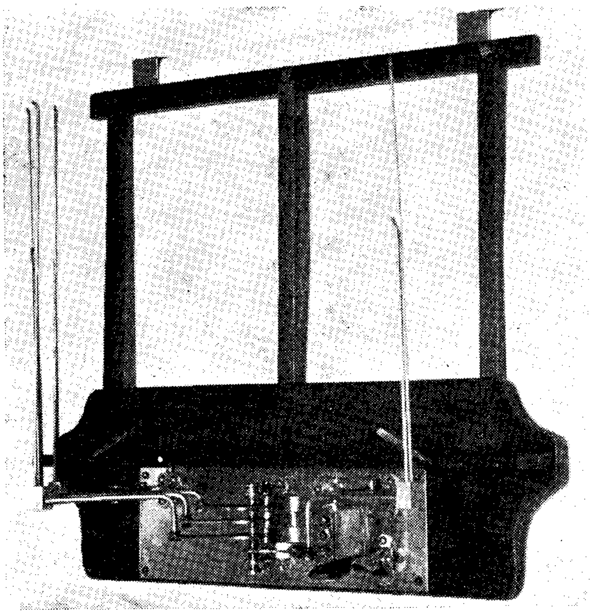


Showing bracket in use for copying sketches

As a trainee Teacher, and Student at an Emergency Training College, I have found this episcope invaluable and comparing very favourably with projectors costing many times the total expenditure.—J. R. RUSSELL.

A Music Leaf Turner

by B. Jefferies



THE design of the music leaf turner here described is not original. More than fifty years ago I saw, in an illustrated list of musical instruments sold by a Malvern firm, a picture of a leaf turner. I do not remember the name of the firm much less the price of the machine, for pocket-money was so limited that purchase was out of the question. In fact, I don't think I gave it a thought. But being then a learner in the art of piano strumming and of a mechanical turn of mind, I said to myself, "What a good idea!" and, as the illustration showed the construction of the machine very clearly, I decided to try my hand at making one.

I had not then the means, nor the tools to make it all of metal, as it appeared to be; so I used wood, wire and such sheet metal as I could get. However, the machine worked quite well and I had the great satisfaction of seeing the leaves of music fly past while playing nonstop.

In course of time the machine got broken up, but I happened to keep in a scrap-box the gadget that let the leaves turn one by one. Frequently, in later years, the sight of that relic awoke the desire to reconstruct the machine more like the original illustration which I remembered quite well; but that was as far as it went, and my mechanical efforts turned in other directions.

Then, some months ago, I had the great privilege of watching, at close quarters, an organist playing an elaborate fugue on a three-manual instrument. He had someone with him to "turn over"; for, what with 3 manuals, 50 stops, swells, couplers, pedals etc., his hands and feet were fully occupied. Then the urge to construct a music leaf turner like the old picture came over me in full force, and so it came about that the machine here described was made.

Construction

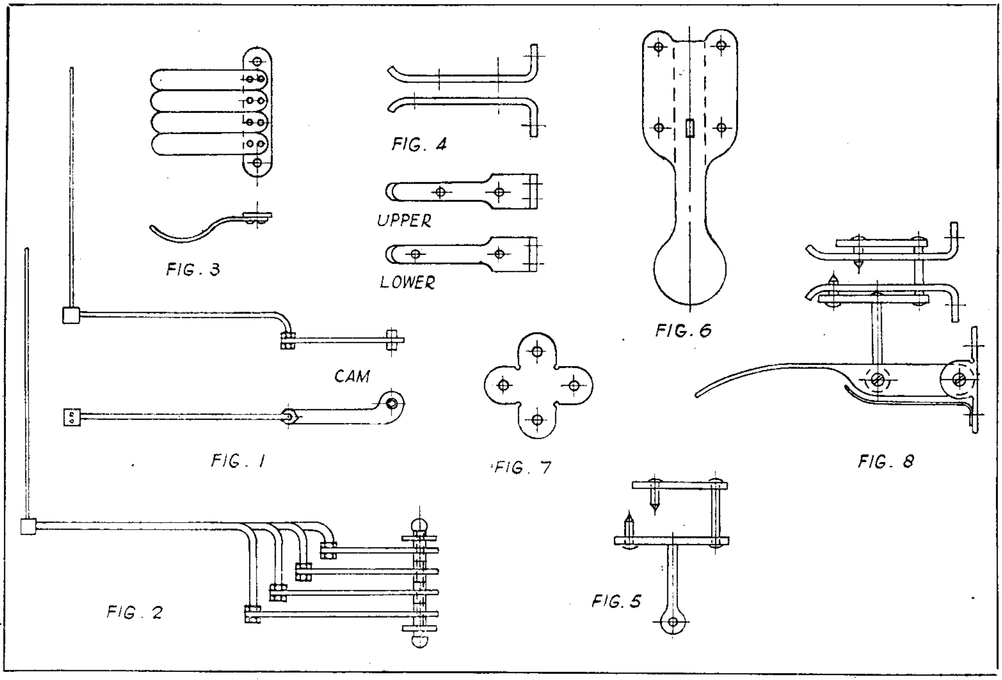
The leaf turning movement is brought about by brass cams on a common shaft acted upon by springs—sections from the spring of an alarm clock. The music leaves are placed between wires, tandem cycle spokes which seemed just the right thickness and already suitably threaded for fixing. For the machine I made in my early days I used steel knitting needles.

The turning gadget is so arranged that it sets free one leaf and holds the next back. The turning key is fitted with a spring so that all that is necessary to do at the right moment is to strike the key with the nearest available finger or thumb. The mechanism of the machine is fixed to a brass plate which, in turn, is screwed to the baseboard. In the illustration I have mentioned, the machine was fixed on a music stand such as are used by an orchestra; but for our piano, I made a replica of the usual music rest, to which the baseboard is fixed. When in use, the piano music rest is folded over behind the front panel and the leaf turner clipped in its place, an operation which takes only a few seconds.

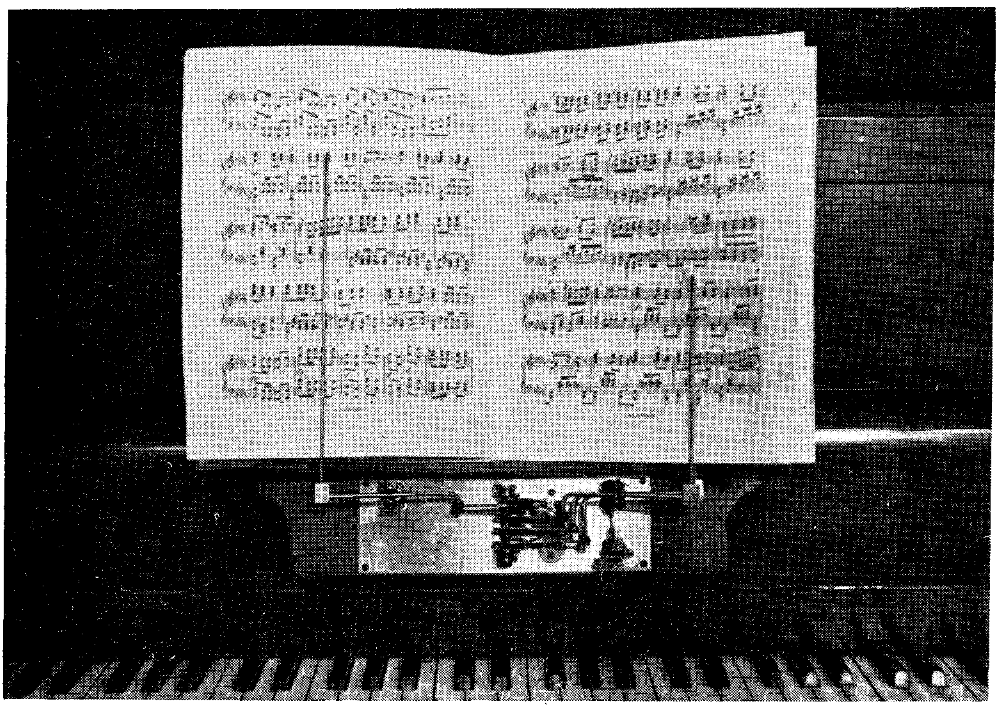
The brass plate on which the mechanism is mounted measures 9 in. by 3 in. and is $\frac{1}{16}$ in. in thickness. Similar material is used for other parts of the machine. Attached to the brass plate are brackets supporting the shaft on which the cams turn.

The cams have short lengths of brass tube fixed at the turning centre which act as distance pieces between them and provide bearing surface which ensures their swinging evenly. Each cam is shaped more or less like an eccentric sheave elongated in one direction. At its end a brass rod, bent as shown, is fixed-nutted and soldered. This is screwed into a cubical brass block supporting the steel wires between which the music leaves are placed (Fig. 1).

It will be seen from the sketch (Fig. 2) that the cams vary in length, thus enabling the rods and blocks to lie snugly side by side. If desired the block could be made adjustable on the rod with set screw, but for ordinary sheet music a distance of $5\frac{1}{2}$ in. to 6 in. from centre shaft has



Detail sketches of the music leaf turner



been found satisfactory. The wires are 10 in. and 6 in. long, respectively, the longer one to be behind the leaf to be turned.

The springs actuating the turning cams are mounted on a narrow brass plate which in turn is screwed to the base plate (Fig. 3).

The steel shaft on which the cams turn is "decorated" with a brass knob at each end, the lower one being removable.

Brass guide blades are provided between which the cam rods lie when at rest (Fig. 4). Those on the right form part of the leaf turning mechanism. This is built up and consists of two narrow strips of brass connected by a steel rod. Each has fixed in it a short steel point which moves through a hole in its respective guide blade (Fig. 5).

The lower brass strip is connected with the finger key. This is formed, as sketch, bent to shape as indicated by dotted line (Fig. 6), and is attached to the base plate by a hinge which also is bent to shape (Fig. 7).

The finger key is supported by a small spring secured by the lower screw fixing the hinge to the base plate (Fig. 8).

To use the leaf turner the cam rods are placed one by one between the blade guides of the turning mechanism and the leaves of music to be turned placed between the wires. The remaining music leaves may be held in place by the usual clips on the piano music rest.

It will be seen that when the key is depressed the lower steel point gets out of the way of the cam rod while the upper point blocks the way of the next one. It is important that the distance between the steel points be equal to the diameter of the cam rods.

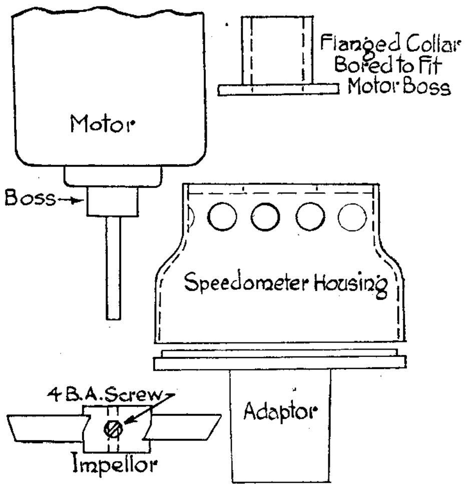
I have never seen any kind of music leaf turner on sale or advertised, except the one referred to, nor have I met anyone else who has; so I look upon the machine as a novelty which is of little practical use, otherwise the idea would have been developed and improved on. After all, its uses are very limited. The picture in the advertisement and the machine I first made would accommodate six leaves of ordinary sheet music. But much music, oratorios for example, is not of that size, and the music of some musicians may be loose-leaved or torn. Some music, too, is thoughtfully so printed that an easy passage or pause occurs at the bottom of the page to be turned. And then there is the trouble of placing the leaves ready for turning. So musicians still "dog ear" the leaves carefully and either rely on an assistant to "turn over" or take their chances and hope for the best!

Steam Raising by Electricity

NEVER before have there been so many fractional horse-power electric motors available at such modest prices. The model engineer no longer has any excuse for not making himself a toolpost grinder, a high-speed drill, and the many other small pieces of equipment in which the key component is a small electric motor.

Having paid 20s. for an ex-U.S. air force camera, I found that the motor on it would run quite well on 6-V. I first used it to drive my home-built 9.5 projector, but finding it somewhat irksome to use a tyre pump for raising steam in my locomotive, I followed the example of many other locomotive enthusiasts and made myself an extractor for fitting into the chimney.

Whilst the accompanying drawings will explain most things, I would mention that in my case, the body of the extractor once did duty as the housing for a speedometer, hence the shape it is drawn. A piece of barrel in any type of metal would, of course, serve equally well.



On the particular motor I used, there was a boss at the spindle end, so I turned up a flanged collar to make a good push-fit on this boss. The flange formed the means for securing the collar to the body of the extractor.

The business part of the extractor consists of a brass boss, to which two blades, also of brass, are silver-soldered. They fit into diagonal slots cut in the boss, but this is not necessary, as they could be secured on the full diameter.

The housing has an end-plate in which is fitted the adaptor which passes into the chimney. It will be noted that a number of holes are drilled round the housing to allow the smoke to escape.

When away from home and no mains current is available, the 6-V car battery is used, but at home I run off a transformer at 15 V a.c. On the latter voltage, steam raising is much quicker, but even so, on the lower voltage it is still highly satisfactory although it takes longer to get enough steam to work the engine's blower.

—P.G.T.

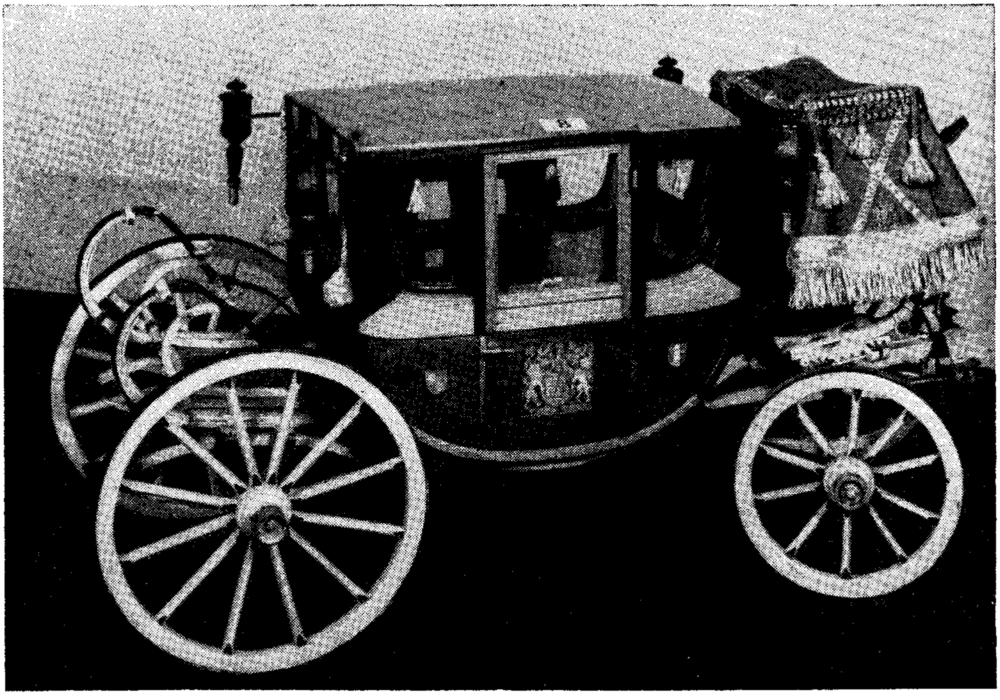
"Better and Better"

"Our" Exhibition

THERE is a tradition that institutions of long standing and deep roots are bound by their solidity to become monotonous and stodgy in the course of time, but this certainly cannot be said to apply to the "M.E." Exhibition. The reader may be pardoned for some mild scepticism on being told continually that the Exhibition gets better and better ever year, but it is an undeniable fact that each year brings some elements of novelty, not only in mere details of the Exhibition, but also in its general layout, and most of the changes are definitely for the better. One of the first things noticed in this year's Exhibition was a complete rearrangement of the stands, which gave the impression of a more liberal spaciousness, though the design of the stands themselves was somehow more compact and intimate. The new position of the arena for running models, which made it literally as well as figuratively a central feature of the Exhibition, was undoubtedly an improvement.

Both the Competition and Trade stands gave evidence of new ideas and new tendencies in the progress of models, tools and workshop equipment. In the former section, there was certainly no lack of the familiar types of models which have always been the backbone of model engineering, but there were also quite a number of models representing the modern development of engineering and industry. It will be quite understood that no attempt is made here to give a critical survey of the models or to encroach upon the territory of the judges who this year undoubtedly had a more than usually onerous task of assessing the merits of the models. All that is done here is to give impressions gained during the early hours of a preliminary survey.

An outstanding model, which was quite rightly given a prominent place on the competition models stand, was that of the North Scotland Hydro Electric Board water-driven turbine, by E. H. Evans, of Sevenoaks. The constructor of this model has produced a somewhat similar type of exhibit in previous "M.E." Exhibitions, and has gained several awards, and this model was quite definitely in keeping with the standard of the former models. Two very fine steam engine models of a type which has been popular in the past, but has not commonly been seen in recent years, were the semi-portable undertype compound engines by Messrs. Kent and Tapper, and the semi-portable steam engine by Messrs

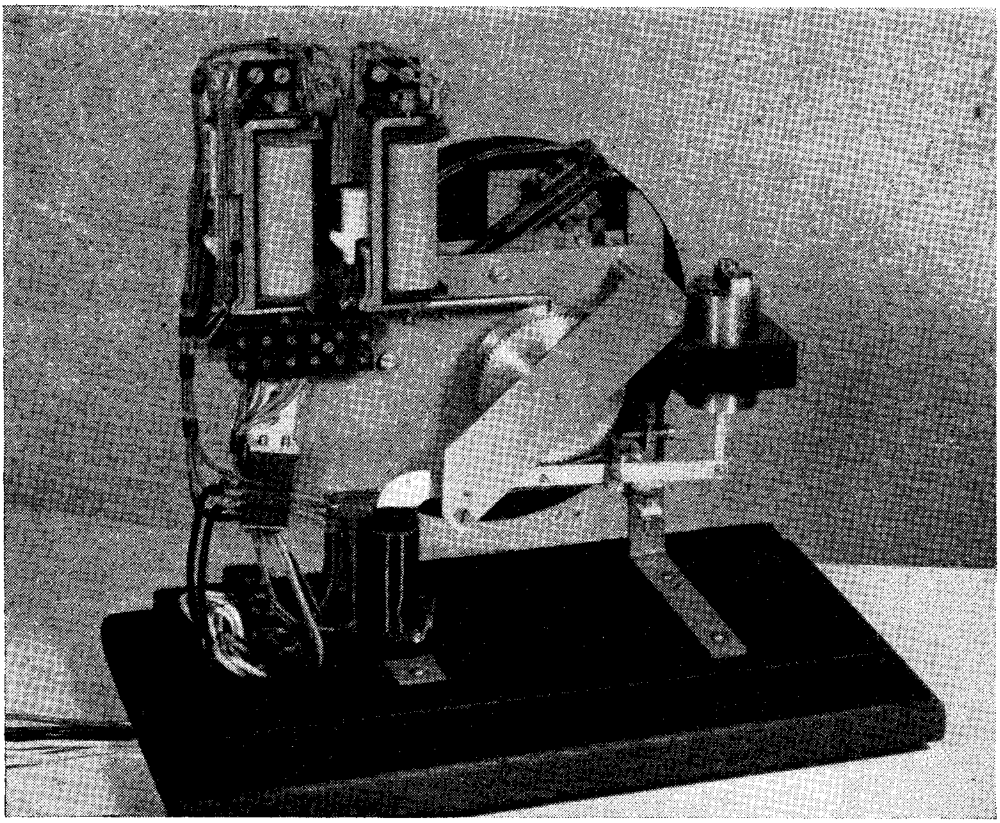


A Lord Mayor's coach built and loaned by P. Winton, of Wembley. Mr. Winton, who was a coachmaker by trade has made over thirty models of gigs, hansoms, victorias, etc. No nails were used in the construction of this model. The body is hung on perch with elliptic and "C" springs, and is attached with straps

Kent, Tapper and Moulson. The reduced scale model of the well-known "M.E." beam engine, by R. A. Barker, of Sheffield, was another interesting example of "period" design in engineering models.

Internal combustion engine models were, as usual, comparatively few in number, but by no means lacking in interest or general quality.

Tools and workshop appliances were possibly a little less interesting than they have been in some previous exhibitions, but there was nevertheless, a good variety in this display, and the general standard was high. A rather interesting example of precision equipment was the universal rotating and dividing table by A. E. Bowyer-Lowe, of Letchworth, and somewhat unusual



The secondary clock and chiming mechanism for operation from ¾-sec. electric master clock, by G. R. Haupt

Modern tendencies in design were shown by the split single two-stroke compression-ignition engine by E. J. Newton, of Stockwell, and also by the tiny c.i. aero engine by G. A. Barlow, of Crawley, which is fitted with a supercharger. Model racing car engine design was represented by the direct-drive 10-c.c. Craftsman twin unit by H. Rae, of Great Malvern, who also exhibited a single-cylinder 10-c.c. racing engine, and an ultra-modern example of design was the complete motor-car chassis fitted with a twin-cylinder supercharged two-stroke engine, by E. H. Lock, of Hucknall. Several examples of designs published in the past in THE MODEL ENGINEER and its associated publications were shown, including a 15-c.c. Kittiwake engine by E. Hinchcliffe, of Rochdale, and a 10-c.c. Ensign petrol engine which was unique in being one of the few models entered by a lady, namely, Mrs. D. H. Duncan, of Worthing.

items included the split nut and apron for a lathe by S. H. Abigail, the lathe apron for a $3\frac{1}{2}$-in. Drummond lathe by W. H. J. Goatcher, of Patworth, and a hand-press for piercing, punching and bending sheet metal by E. A. Lee, of London, N.15. An example of the rear tool-post described in THE MODEL ENGINEER by "Duplex" with some modifications was shown by R. Thurley, of Newbury, and there were also examples of milling spindles, dividing-heads and several drilling machines of various types, including the now familiar "M.E." design, with or without modifications.

Non-working models presented some novelties, including a "Corgi" light-weight motorcycle, by E. Stannard, of London, E.17, two motorcycles made in wood by A. Mocogni, of Sunderland, and a group of historic racing cars by A. Ward, of Croydon.

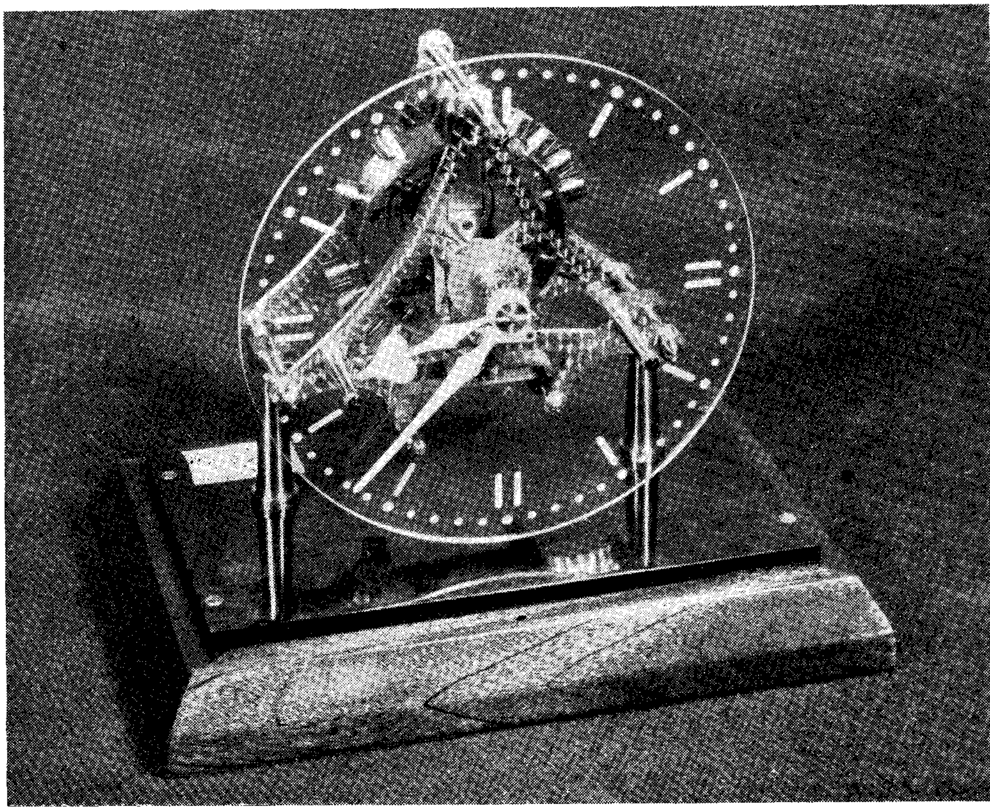
Scenic and representational models included

some excellent representations of historic buildings, a very fine example of a fire engine by F. E. Bailey, of Thornton Heath, and a showman's fairground scenic railway by A. E. Dandridge, of Headington.

As usual, there were some very fine examples of horological work including the exquisite miniature bracket clock by the veteran exhibitor, C. B. Reeve, of Hastings, an electric clock based on the "Eureka" design recently described in THE MODEL ENGINEER, but with some very notable and ingenious improvements, by A. E. Bowyer-Lowe, of Letchworth, also two very fine examples of the "M.E." cine-projector by I. P. Holden, of Windermere and A. and A. R. Kidd, of Watford.

Period furniture was represented by the very interesting group, including a Cromwellian gate-leg table, three Lancashire chairs and a spinning wheel by F. D. Mallett, of Epsom.

Little need be said here of the locomotive, aircraft and marine exhibits, which are being adequately covered by specialists in these particular classes of work, beyond saying that the general standard in each class was undoubtedly high and several novelties made their appearance. The anachronisms and incongruities in all types of models, though always with us, were neither so numerous nor so glaring as they have been in the past.



Modified "Eureka" electric clock with epicyclic reduction gear and motion work by A. E. Bowyer-Lowe

Trade Section

In the trade section, perhaps the most notable tendency was a general return to real model engineering, and there was a marked absence of the type of exhibit to which many model engineers have objected in the past. Tools and equipment show steady progress, and there is a sign that really sound lathes, at a price within the reach of most prospective model engineers, are beginning to make their appearance. The Myford stand was notable for the demonstrations of wood and metal working, and one could not fail to be impressed by the versatility and capacity of the M.L.8 lathe, which seems capable of doing practically any woodworking operations with an efficiency hitherto unprecedented in a comparatively light machine. Some excellent examples of combined woodworking machinery were also to be seen on the Coronet stand which featured a very interesting new metal-working lathe, also small instrument lathes and drilling machines.

The Multi-purpose machine tool exhibited by Slater Frost & Gates was of outstanding interest as an example of ingenious and versatile design, being capable of a very wide variety of machining operations while being comparatively simple in construction, and low in cost.

S. Tyzack & Son Ltd. have reintroduced the popular Zyto $3\frac{3}{8}$-in. screwcutting lathe in an up-to-date and improved form.

Castings and parts for a wide variety of models, including many which have been described in THE MODEL ENGINEER were again featured by several firms, including Kennion Bros. and Dick Simmonds & Co.

Some entirely new ideas in electric motor design were shown on the stand of Multi-Products Manufacturing Co. including some unusually small but highly efficient motors.

Synchronous motor movements and other small instruments were featured by Venner Time Switches who also exhibited an entirely new type of accumulator which offers many advantages for use in connection with models.

Trade Displays

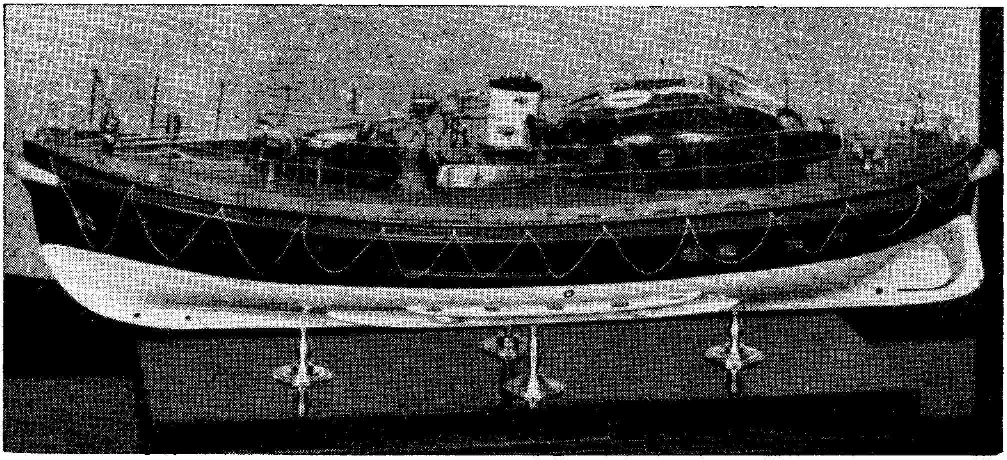
The show cases and sample display stands were equally of interest, one of the finest displays of castings and engine components being shown by Craftsmanship Models Ltd., and a very interesting 10 c.c. petrol engine of a type which has not previously been put in production, was shown by J. & G. Jensen Ltd.

The machine tool attachments by W. H. Marley & Co. Ltd., although, generally speaking, a little on the large side for the requirements of the average model engineer, were nevertheless extremely interesting and ingenious and were, no doubt, of outstanding interest to all engineers, both amateur and professional.

The return of the Pool bench milling machine in an improved form by the Pools Tool Co. Ltd. will be welcomed by many users of small workshop equipment. The display by Z.N. Motors Ltd. featured for the first time a wide and comprehensive range of components for model racing cars, all of which were of modern design and excellent workmanship.

The Power Boats

THE interesting feature of the power boat exhibits this year was the diversity of types chosen as prototypes for the models and a definite break from the domination of the A.S.R. type of launch, so pronounced during the last two exhibitions.



A fine model of the Mumbles lifeboat by Mr. H. G. Swarts, coxswain of the Barry lifeboat. A somewhat unusual prototype for the modeller but one full of interesting detail

The standard of work was also definitely on the upgrade although many of the exhibits suffered from bad detail design or wrong choice of material.

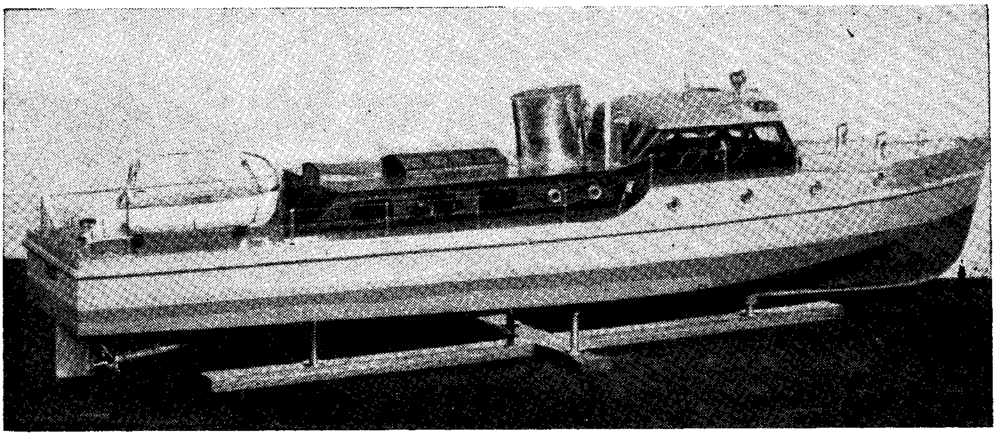
Perhaps the exhibitors will not take it amiss if mention is made of some of the more obvious errors as seen by the writer.

It is appreciated that it is not very easy for the average modeller to obtain full details of every small fitting on a ship, but at the same time common sense and a little imagination will help quite a lot.

Exhibit No. 1 in this particular section was a rather interesting modernistic design for a motor ship by Mr. Wrey-Savile. This gentleman is a deep-sea sailor and so should know what a real ship looks like and the model is not only unconventional but also very "eyeable." Unfortunately, the difficulty of space precluded it from being very easy to examine, so that little could be ascertained regarding its details. The model suggests that all the working details of the vessel, winches, capstans, etc., are covered or enclosed. Though this may make for efficient streamlining, we doubt if Mr. Wrey-Savile, as a practical seaman, would like to work a ship so fitted.

G. H. Davis had two models on view, one of a cargo liner and the other of a "Battle" class destroyer, both very well detailed. Mr. Davis has, we believe, access to very complete detailed information on warships, so that, as may be expected, the details of the destroyer are correct.

A vessel which is not often seen as a working



A very fine free-lance cabin cruiser by O. P. Corderoy, of Isleworth. The lines and finish of the hull are excellent and the entire job is well carried out

model was shown by T. H. Reynolds, a free-lance oil tanker and a very nice looking job it was and one which should look very attractive and realistic on the water.

The popularity of the A.S.R. launch and similar designs is largely due to the fact that a reasonably large scale can be used in modelling and, of course, by the very decided " eye appeal " these vessels have.

T. H. Vinnicombe chose an A.S.R. for his model No. 6 and a very fine job he made of it.

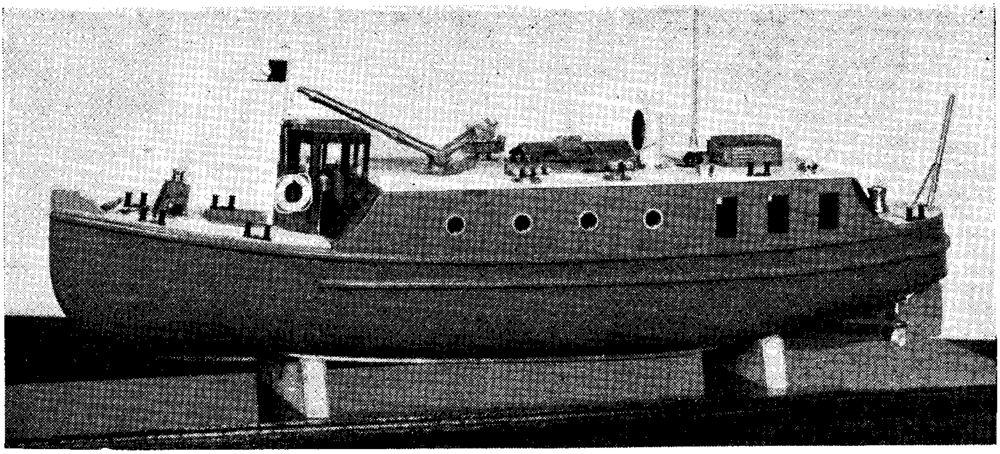
The ever-popular tug was shown in Exhibit No. 7, by Dr. Fletcher, again an excellent piece of work, though whether any tug ever looked as smart as *Chieftan* is rather doubtful. However, the builder has erred in good company in this respect, as a model of the tug *Bustler*, exhibited in one of the London museums, is still more highly polished and finished, even to the extent of white plastic decks !

The popular design for the M.V. *Penang*, published in THE MODEL ENGINEER, produced two very good models based on those drawings, No. 8 *Penang* by G. W. Newman and No. 11, *Two Sisters* by S. V. Hill, both of which were well carried out and should look realistic on the water.

Exhibit No. 9, by B. E. Cook, was a M.T.B. Mark VI, No. 489. The choice of a particular number rather suggests that the builder is familiar with one of these boats, which would account for the very clean job he has made of it. Official drawings seen were not complete enough to indicate whether the deck planking of the model was correct and though very well carried out it is suggested that a marginal cover board would be fitted.

No. 12 was another tug, this time by Mr. Sheldon ; a nice clean piece of work but like the other tugs shown, with far too much polish and finish to look realistic.

The tug *Zwarte Zee*, by W. E. Morriss, was a fine workmanlike job, but from the photograph shown of her afloat she appeared to float



A working model fire float " Massey Shaw " by E. J. Hollingum, of Northfleet. It is radio-controlled and was used for television purposes during the Exhibition

much too high out of the water to look really effective.

One of the most outstanding models in all respects was the steam cabin launch *Barbara*, by O. P. Corderoy. Though this vessel was not built to any special prototype, it was, nevertheless, an excellent type for general club work and would appear to be an efficient performer. The general finish and workmanship of the hull and engine room was excellent, but in the writer's opinion was marred by one or two small details. The boiler firing arrangement of a soaked asbestos pad would appear to offer no very definite advantage over a small vaporising burner, although it may have been fitted with a definite purpose in view. The rims of the portholes were rather too heavy for the model and detracted somewhat from its appearance. The general finish and effect of the deck was excellent but was not improved by the use of a piece of open-grained oak for the roof of the engine-room casing. A piece of neutral-coloured plastic sheet over that to represent the normal roof covering, would be an improvement. These remarks are offered not as criticisms of a fine effort but as suggestions. We understand that this is the builder's first model, and the result of seeing the working models at last year's exhibition. We expect great things of him in the future.

Two exhibits are based on the excellent Bassett-Lowke "Streamlina" hull, No. 18, *Dolphin*, by R. Davey and No. 21, by H. F. Christian, both of them very nice efforts and boats that should perform very well. The hard chine hulls of these vessels are a very good shape for a general purpose boat and should give a fair turn of speed and be efficient steerers.

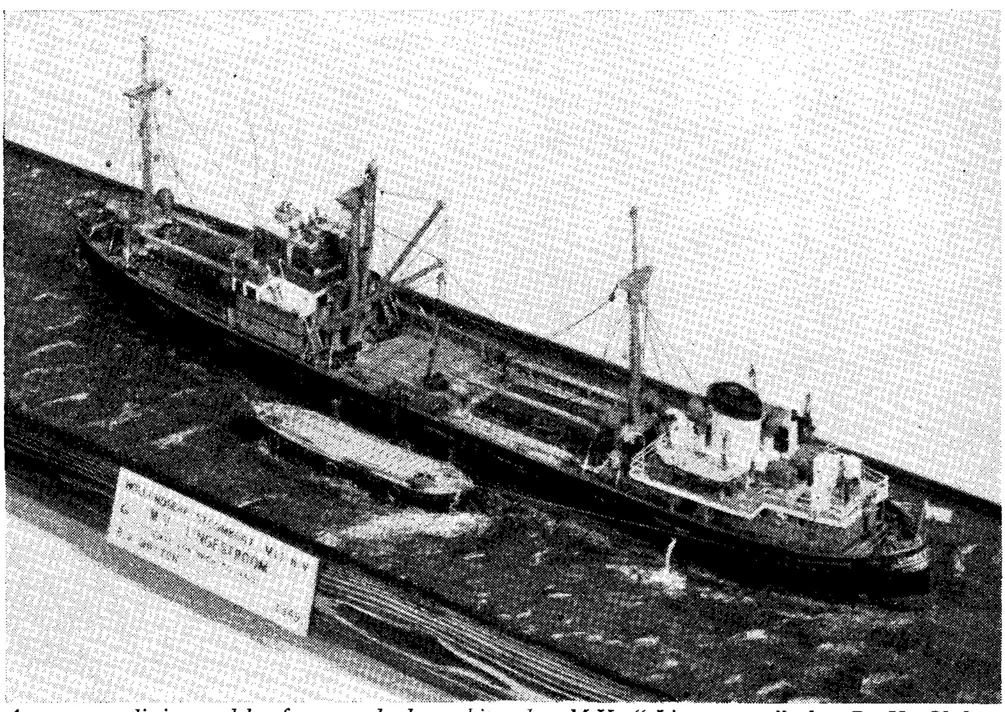
No. 19, an "M" class destroyer, by W. Croft, is a fine, powerful-looking job, well executed and with No. 20, a "Kingfisher"-type patrol vessel by N. H. Burrow, completes the naval side of the exhibits.

No. 22, by E. A. Walker represents, on a small scale, the beamy, somewhat ugly, but efficient small Broads cruiser so popular for the amateur yachtsman's holiday.

No. 23, by A. V. Herbert, is yet another tug, steam powered, but here again space difficulty prevented a detailed examination.

Exhibited in the "non-propelled models" section, Class 4 was a model well worth inspection. No. 12, by L. Baker, is a free-lance design of a cargo vessel to a scale of $\frac{3}{16}$ in. This, we understand, is a first effort at ship modelling and is later to be fitted out as a power-driven model. Though suffering from several detail errors, it is to be commended as a very realistic-looking, well-proportioned job, and the treatment of the decks, in particular, is very good.

Class 8, for hydroplanes and speedboats, was not very well represented, though No. 2, a naval launch by L. C. H. Sills, was an attractive-looking vessel and represented a type of boat that is very neglected by the modelmaker. The fast naval launches, examples of which were to be seen on the aircraft carrier model on the Royal Navy stand, would make very fine prototypes for models and are small enough to be modelled to a large scale.



A very realistic model of a workaday ship, the M.V. "Lingestroom," by R. V. Shelton, of Dunstable

"Duplex" Visits the Exhibition

LAST year we wrote an account of our visit to the Exhibition and this year we have again been asked to record our impressions.

As readers will probably have observed, our main interest lies in machine tools and their development by means of fittings and attachments to further increase their utility. But, as has previously been emphasised, it is essential in the first place to acquire machines of sound design and good workmanship to render such addition and alteration profitable, for little but disappointment will be experienced later if time and trouble are spent on elaborating a fundamentally faulty machine.

One of the first things that struck us this year, and this impression is confirmed by experienced observers, was that the standard of design, workmanship and finish exceeded that of last year; in fact, at first sight there did not appear to be any machines that would not give good service.

The reason for the absence, and, we hope, disappearance, of the poor quality machines is probably explained by the fact that the sellers' market has regressed, as the economist would lead us to believe; and with this reluctance on the part of the buyer to purchase any goods offered for sale irrespective of quality, must be added his ability to discriminate between the reliable machines manufactured by reputable firms and those made for the most part merely to sell when goods were scarce.

This maintenance of better engineering standards will undoubtedly strengthen the position of manufacturers when selling their products both in this country and abroad.

A visit to the Myford stand showed that the lathes exhibited had been improved mainly in detail work; thus, the M.L.7 type now has sight-feed lubricators fitted to the mandrel bearings, and the latest pattern tool clamp is strengthened by a ribbed-form of construction.

The new design of lathe tools made by this firm has a hollow milled out on either side to enable it to be readily set to centre height when mounted on a base piece of crescented form; this is, of course, an application in reverse of the method of using a curved member, or boat as it is called, as part of the tool clamp as in the American type of toolpost. When the height of the tool is adjusted in this way, and as a result the tool itself does not lie horizontal, the value of the front clearance angle is altered, but only to a small degree if the precaution is taken of packing the tool up to approximately the correct height and then using the tipping motion merely to effect the exact setting. Apart from the question of rigidity, one of the disadvantages of the American type of toolpost is that the tool cannot readily be operated close to the chuck jaws, but this is overcome both in the Myford tool and in the Boley pattern toolpost by using an open-sided toolclamp or tool box. Nevertheless, the four-tool saddle turret fitted to the topslide is rapidly gaining popularity, and with this device the tools are set individually to centre height by means of packings and need not then be disturbed until regrinding becomes necessary.

Great interest appeared to be taken in the performance of the M.L.A. woodworking lathe, and this is hardly surprising considering that this lathe has been specially designed to meet the needs of the general user who may be confronted with a great variety of work in addition to straightforward turning and sawing operations.

Angular sawing and rabbeting are readily carried out, and for the latter operation a wobble-saw is used, that is to say the saw itself is mounted on a special fitting which allows it to be set obliquely to the long axis of the arbor; the saw teeth will then cut a groove in the work of a width depending on the amount of wobble used.

In our next issue it will be possible to publish photographs showing turning and angular sawing operations in progress.

Most of the well-known popular makes of small lathes are exhibited, notably, the Halifax and Acorn lathes by Messrs. Acorn Machine Tool Co. Ltd. The Halifax lathe is of 5 in. centre height and the mandrel is mounted on Timken taper roller bearings; a self-contained vee-belt drive is fitted in connection with an electric motor of 1/3 or $\frac{1}{2}$ h.p.

Messrs. Tyzack again show the Zyto lathe of $3\frac{3}{8}$ in. centre height which has been so popular with amateur workers in the past. This lathe of simple straightforward design and economy of fittings serves to maintain the comparatively low price.

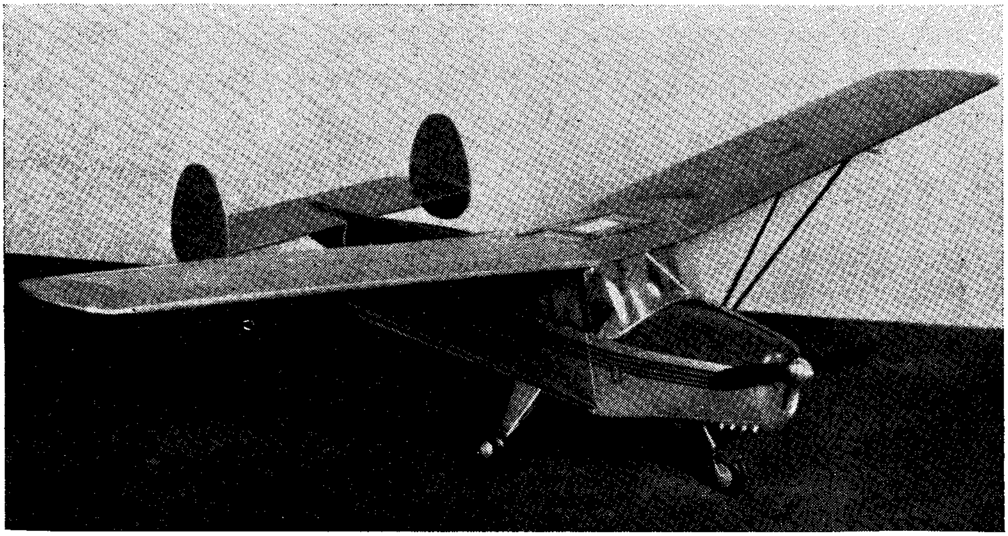
Watch and clock making and repairing appears to be gaining favour with amateurs, and in recent years the absence of small precision lathes of German or Swiss manufacture has proved a handicap even to those workers who adopt the recognised practice of turning pivots solely by means of hand tools and without the use of slide-rest. Fortunately, this lack of lathes suitable for fine work appears to be met by the manufacturers of the B.T.M. British made lathe exhibited on the stand of Messrs Buck & Ryan.

This small lathe is of 2 in. centre height and is fitted with a bar bed having a locating surface on its upper side. The mandrel runs in plain taper bearings and is adapted to carry draw-in split collet chucks of a maximum through capacity of approximately $\frac{3}{16}$ in. The lathe can be supplied either with or without a slide-rest and numerous additional accessories are also available.

In the competition section we noticed what appeared to be an interesting small lathe designed for watch and clock making and other fine instrument work. A compound slide-rest and a lever-feed are fitted; in addition, a four-jaw chuck made by the entrant himself is mounted on the mandrel.

Next week we hope to record our impressions of other types of machine tools, as well as any novelties in hand tools and small workshop equipment; at the same time, it should then be possible to illustrate the review with suitable photographs.

The Model Planes



A fine example of scale modelling. This Chrislea " Ace," by E. W. Dyer, of Norbury, London, S.W., attracted a good deal of interest. It is built to a scale of 1¼ in. to 1 ft., weighs 12 oz. and is powered by an E.D. " Bee " 1-c.c. compression-ignition engine

MODEL aircraft are very difficult objects to display to their best advantage, especially when space is as limited as it was in the Competition Section. Last year an endeavour was made to overcome this problem by hanging the whole of the model aircraft entries above the heads of the viewers. As might have been anticipated, this was not a success—after all, one would not dream of suspending railway locomotives in this fashion, thus making it impossible to examine anything other than the underside.

However, the organisers of the Exhibition are always ready to profit from past experiences and this year they arranged the model aircraft exhibits in a separate section where they formed a very attractive display. The models were arranged against a sky-blue background and they were well lit by fluorescent strip lighting—the whole effect being very pleasing to the eye.

To come to the models themselves ; one was immediately struck by the increase in the popularity of flying scale model aircraft and nearly all the examples of this type which were on show displayed really excellent workmanship and finish. So much so, that it is difficult to single out particular models. A really outstanding model, however, was a free-lance flying model biplane by J. A. Newton, a member of the Blackheath Model Flying Club, which featured a dummy radial engine. The planked fuselage of this model in particular is beautifully finished and it is well worthy of the silver medal which it won.

Lovers of historical aircraft will be especially interested in the Bristol Biplane Racer of 1911 vintage entered by E. E. U. Rogers, of Weybridge, which also won a silver medal. This model is powered by a 10-c.c. petrol engine and features pendulum-operated controls. Another model worthy of mention in this class was a scale Auster J.4, built to a scale of 1½ in. to 1 ft. and entered by D. Wynch, of Nottingham, which has an E.D. 2-c.c. compression-ignition engine for its motive power. The neatness of the detail finish on this aircraft is noteworthy.

The model of a Chrislea Ace aircraft by E. W. Dyer, of Norbury, which we picture above, won a bronze medal. It has a real exhibition finish, despite the fact that it has had a fair amount of flying—and is a great credit to the builder.

It is very easy to overlook small models in an exhibition, although the workmanship in them may be far better than that in the larger exhibits. A ½ in. to 1 ft. scale model of a Hawker Hart day bomber was a good example of this. An amazing amount of authentic detail has been incorporated in this model and it is worthy of a silver medal.

Although there was no weeding-out of entries this year, there were no models on display which were not well up to exhibition standard—in fact, it could truly be said that the Model Aircraft Section was the finest show of these models which has been seen for some years.

A "Utility" Steam Plant

by E. R. Rogers

THE following is a brief description of the plant shown in the accompanying photo :—

The engine is a fabricated version of the "Trojan" described in the "Utility Steam Engine" articles. No castings were used in its construction. The fittings include a displacement lubricator and a stop-valve.

The engine cylinder was made from an odd solid and the bottom cylinder cover made from sheet brass, the gland bosses in both cases being made separately and silver-soldered in place. The bedplate is $\frac{1}{8}$ in. brass sheet. All other fittings are as per drawing, the necessary adjustments to height and length being made to compensate for the absence of bosses on the baseplate and bottom cylinder cover.

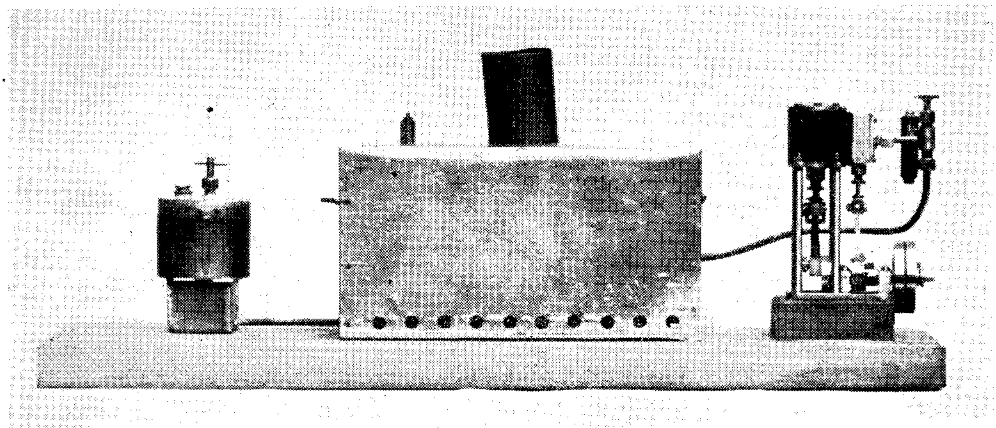


Photo by] *Mr. Rogers's "Trojan" outfit* [*C. Boyles*

piece of $1\frac{1}{2}$ in. diameter bronze rod. This was set up in the 4-jaw chuck, one end faced and a truing cut taken over the outside. After parting off, leaving enough for facing, the plan view of the cylinder was marked off on the end. The centre-lines and the edges of the valve face were also marked off during this operation. Having set the end square and the bore running true, the bore was drilled and bored out about 3/100 in. undersize. The finishing cut was made with a floating cutter of $\frac{1}{8}$ in. $\times$ $\frac{3}{8}$ in. section held in a slot in a $\frac{3}{8}$ in. diameter bar fixed in the tool-rest, the cutter being given a lead by boring out $\frac{1}{16}$ in. of the bore to dead size. Turning at slow speed and feeding slowly, the bore was very satisfactory. The block was then set up with the valve face outward, set true and faced off to the scribed lines. As an aid to setting-up, a pointed wire was sweated into the end of a piece of $\frac{1}{4}$ in. sq. M.S. bar, an extension of the pin in a piece of wax on the end of the tool idea that I used in my younger days. This method of machining was necessary owing to the lathe not being supplied with a faceplate. After lining out the ports, drilling and cutting with small chisels and drilling the passages, the rest of the work on the cylinder was only hack work with saw and file. The steam chest was cut from the

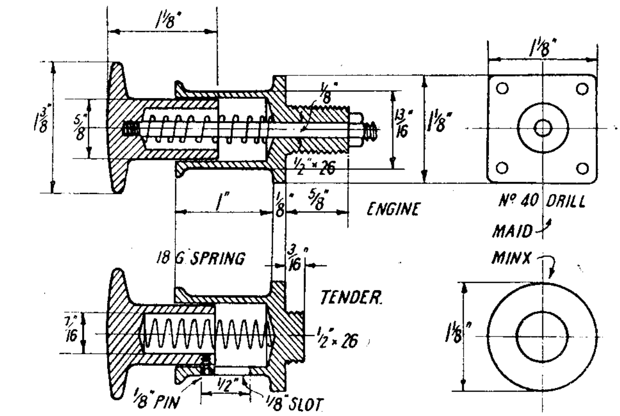
All machining was done on a hand-driven "Rollo-Elf" lathe, no other machine tool being available.

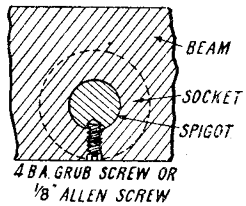
The boiler consists of a $5\frac{3}{4}$-in. length of 2 in. diameter copper tube with $\frac{1}{16}$ in. thick copper flanged ends silver-soldered in place. It is fitted with three No. $\frac{3}{16}$ in. "Averill" type water-tubes and has a spring-loaded ball safety-valve. The 5/32 in. central stay is extended both ends and serves to support the drum in the casing which is of stout gauge tinned-steel plate bent up in one piece and riveted with $\frac{1}{16}$ in. diameter iron rivets. It is lined with $\frac{1}{16}$ in. thick sheet asbestos. Steam is taken from one end of the bottom of the boiler, the pipe extending internally to the top of the drum. Leaving the boiler, it extends the length of the casing in the flame to obtain a measure of dryness. The lamp consists of a single burner $\frac{1}{4}$ in. wide by $4\frac{1}{4}$ in. long filled with asbestos wick and fed by a $\frac{3}{16}$ in. diameter tube from a rectangular sump under the spirit container. The sump is supplied on the chicken-feed principle, the container having a central needle-valve and a $\frac{3}{8}$ in. diameter air tube extending into one end of the sump. The whole installation is mounted on a board and when running, the engine settles down to a steady "buzz" for 20-25 minutes.

Final Details of "Maid" and "Minx"

by "L.B.S.C."

AS with life itself, all things come to an end at last; and with this instalment, the tale of the two 5-in. gauge locomotives reaches its final chapter. It will not, of course, mean the end of the job for many of the followers of these notes who have built the engines. Although they are not, and were never intended to be, exact replicas of the Southern "L1" class and the rebuilt "Vulcans," but just two little machines designed and intended for real work on 5-in. gauge, following full-size "C.M.E. procedure," they bear the family likeness well enough to be titivated up with all their full-sized relations' ornaments; and readers who have the time and inclination to do this, can get a good close-up photograph from any firm who specialises in locomotive pictures (e.g., the Locomotive Publishing Co., of Westminster) and let themselves go to their heart's content. Mind you, I have more than a sneaking regard for those good folk who fit various adornments for sentimental reasons; I've done it myself on "Grosvenor." For instance, just under the shovelling plate on the tender, on all the Brighton engines, there was a bent-nosed water-cock. I have drawn hundreds—nay, thousands of pailfuls of water (nice and hot on the Stroudley engines) in which to wash my face and hands before booking off; I never could bear to be seen in the street with a grubby face. More than one cheeky young scamp of a cleaner-boy wanted to know if I carried a mirror and powder-puff in my tommy-bag! Well, there is a weeny "scale" replica of that water-cock on "Grosvenor's" tender; the water-way was drilled with a No. 57 drill, and the plug is properly ground in and nutted. It works champion; and although, at time of writing, there isn't any pail to put underneath it, there *will* be, as soon as I feel like a little more "watchmaking." Returning to the "Maid" and "Minx," you will find below, some details and illustration of the essential "trimmings"; and for those builders who only require the engines for their working qualities, these additions will complete them.





How to fix tender buffers on the "Minx"

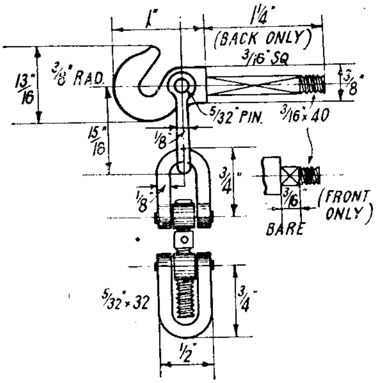
Left—Details of buffers

Buffers

After all the turning and fitting involved in the general construction, the buffers are merely a kiddy's practice job. Our "approved" advertisers will be able to supply castings for the sockets; and these may be chucked in the three-jaw by the body part, and the stems turned and screwed. Note: if the holes in the tender beams haven't been tapped, there is no need to screw the little $\frac{3}{16}$-in. spigots of the tender buffer sockets; just turn them a tight fit for the holes. Chuck by the stems, and drill out the sockets as shown. Those for the tender will need a ⅛-in. slot ½ in. long, milled in the underside; and this may be done with the socket clamped under the lathe tool-holder, and traversed across a ⅛-in. dental burr or a home-made slot drill held in the chuck. That job won't worry anybody who has milled their steam ports.

The heads can be turned from stub ends of steel shafting, any available diameter over 1⅜ in. Turn the stem first, to a nice sliding fit in the socket; then drill up as shown, to get a longer spring and better flexibility. Incidentally, that wheeze is nearly as old as I am, as it was shown about 60 years ago in the *Boy's Own Paper*, in Hobden's description of a 2-4-0 which no boy—nor anybody else for that matter—ever built. If any of our old-timer readers recollects the "instructions," they won't need telling why! Part off a full 1⅛ in. from the end, reverse in chuck, and turn the heads to profile shown. The spindles of the engine buffers are 2⅝-in. lengths of ⅛-in. round steel, screwed as shown.

Drill and tap a $\frac{1}{8}$-in. or 5-B.A. hole near the end of the tender buffer shanks ; then when assembling, screw a stub of $\frac{1}{8}$-in. rod in, through the slot, which will prevent the head from escaping from the socket. Of course, anybody who prefers, can use the flexible wire bridle, as described for "Doris," in place of the slot and pin.

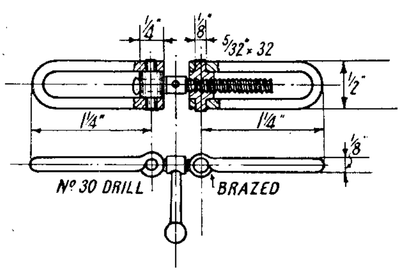


"Southern" type short screw coupling

As the "Maid's" buffers have square flanges with a hole at each corner, they may be attached to the beams by four hexagon-head 3/32-in. or 7-B.A. screws in each. The "Minx" buffers have round flanges ; so put a nut on the shank behind the engine buffer beam, which will hold the buffer securely. On the tender, press the stub stem into the hole in the beam, then drill and tap in the thickness of the beam, either for a grubscrew, or preferably an Allen screw, the point of which will penetrate the stem, and effectually prevent the buffer parting company from the beam.

Drawbar and Couplings

The drawbar hooks of both engines are similar, and merely a plain filing job, from $\frac{3}{16}$-in. steel plate. The front hooks only have short stems, on account of fouling the lubricator tanks ; but the back ones, for the tender beams,

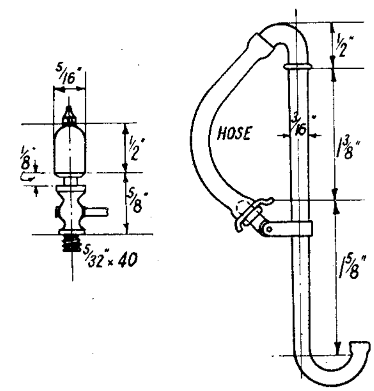


L.B. & S.C.R. type screw coupling

should be made the length shown, and a 16-gauge spring interposed between beam, and fixing nut and washer. *Don't forget to round off all the sharp edges of the hooks* ; very important that ! Drill the holes for the shackles with No. 20 drill.

Two kinds of screw-couplings are shown for the "Maid" ; one is the regular Southern pattern, and the other, the old L.B. & S.C.R. type. The method of making both screw couplings is the same as for "Doris," so there is no need for repetition ; $\frac{1}{8}$-in. rod is used for the shackles, and the screw is turned from $\frac{3}{16}$-in. rod. The difference is in the length of the shackles, and the method of attachment. The Southern shackles are only $\frac{3}{4}$ in. long, from end of bend to centre of pin, and the complete coupling is attached to the drawbar hook by an extra shackle, $\frac{15}{16}$ in. long, from pin to bend. This merchant is hooked through one of the coupling shackles, and then attached to the drawbar hook by a 5/32-in. silver-steel pin through the lot, riveted over both sides. The nose of the hook should be filed, so that you can just pull the whole doings out straight.

The Brighton pattern shackles are longer ; and before bending the one nearest beam to shape, poke the end through the hole in the drawhook, form the eyes, and braze them. The rest is then just all plain sailing. No screw-couplings at all are required for the "Minx," as the Brighton



Dinky ornaments !

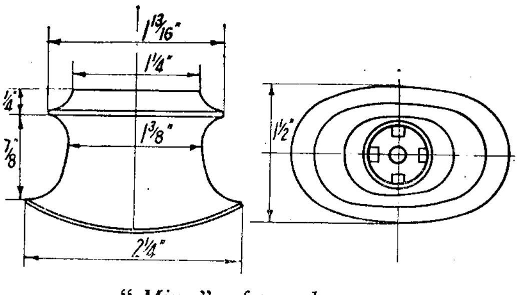
goods engines had merely three-link chains. The two longer links can be made $1\frac{1}{8}$ in. long, and the shorter one $\frac{3}{4}$ in. long ; bend them up from $\frac{1}{8}$-in. steel rod, and braze the joints, as otherwise the engine will pull them open. Don't forget to put the end one through the hole in the drawhook before brazing the joint !

Brake Pipe

The illustration showing the brake-pipe is really a combination one. The pipe itself can be made from $\frac{3}{16}$-in. tube or wire, with a wire ring soldered on just below the swan-neck, to represent the joint between pipe and bend on the full-sized engine. The hose, socket, and dolly or dummy plug, are made and fitted as described for the L.M.S. job, but to sizes given here. The lower part of the pipe is not required for the front of the engine ; cut it short $1\frac{5}{8}$ in. below the swan-neck, screw the end $\frac{3}{16}$ in. by 40 for about $\frac{1}{4}$ in. down, drill and tap a hole to suit, in the top of the buffer-beam, and screw in the pipe. Looking at the beam from the front, the hole will be about $\frac{3}{4}$ in. to the left of the drawhook, and about $\frac{1}{2}$ in. from the front edge of the running-plate

The clip for the dolly can be screwed to the front of the beam, close to the top.

For the pipe at back of tender, make the whole issue as shown, and attach at top and bottom of beam by a couple of brass clips about 5/32 in. wide, secured by 8-B.A. screws. The hook at the bottom goes under the beam. Locate about $\frac{3}{4}$ in. to left of drawhook. These pipes are only



"*Minx*" *safety-valve cover*

for appearance's sake, as if left off, they are conspicuous by their absence, in a manner of speaking. Note: they are required on the "Maid of Kent" only. The "Minx's" big relations have the air brake; and the pipes for this, are small hoses attached to connections under the beams. They are so unobtrusive that they may be left off altogether.

Safety-valve Casing for "Minx"

This is an oval casting, of shape and dimensions shown. It only needs cleaning up with file and emery-cloth, and drilling to take the body of the safety-valve. Should a casting not be available, you can do the same as I did with the safety-valve casing of exactly similar pattern on old "Ayesha." This was turned circular from a suitably-sized piece of brass rod, and squeezed oval, between lead clams, in the bench vice. Strange to relate, that obvious and simple trick has puzzled many good folk! No fixing is required; just slip the casing over the valve, and you only have to lift it off when the valve needs removing for any purpose.

Dummy Whistles

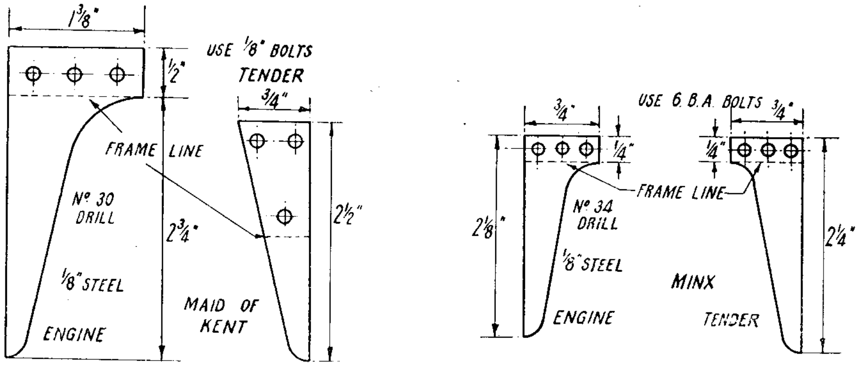
The dummy whistles are just another kiddy's practice job; just a bit of plain turning on a piece of $\frac{5}{16}$-in. round brass rod held in the three-jaw. Turn the bell part first, then part off to full length. Reverse in chuck, holding by the bell, turn and screw the end as shown, then turn the part representing the valve. Form the groove below the bell with a parting-tool. Screw the completed dummy into the boiler shell of the "Maid," just in front of the cab, and fit a bit of 16-gauge wire to simulate the handle. The dummy whistle on the "Minx" is simply a bell, made as described above, with a screwed spigot to attach it to the top of the cab, as shown in the general arrangement drawing and blueprints.

Guard Irons

The guard-irons can be filed up from bits of steel left over from the frames, and no detailing is needed for that simple job. They are attached to the outside of the engine frames, and inside of the tender frames, by screws, and the lower ends are bent to come over the rail-heads when the engine is on a bit of straight line. Allow about $\frac{1}{4}$ in. between guard-iron and rail. The front end frame screws on the "Maid," may be utilised to hold the guard-irons also.

Sanding Gear

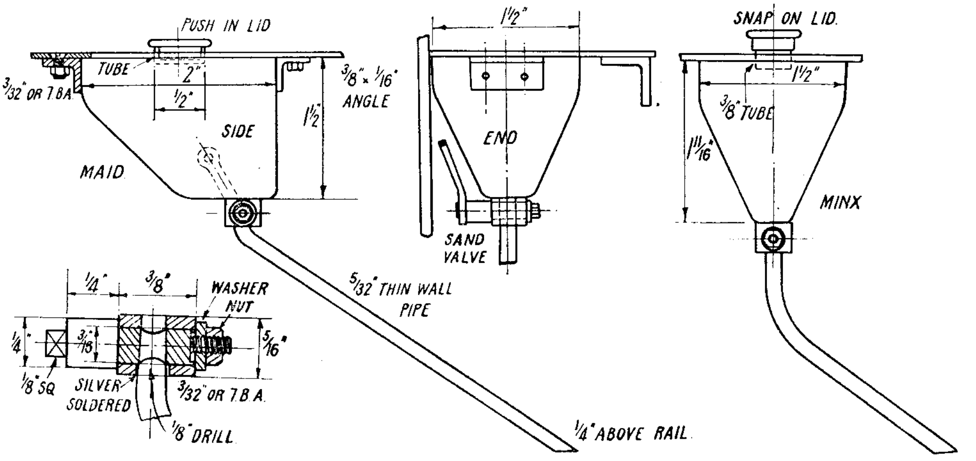
The simple expedient of spreading a little dry sand on the railheads, completely nullifies the moans and groans of the theory and calculation department about big cylinders causing excessive slipping. Those clever and crafty old veterans, Pat Stirling, Sam Johnson, and Bill Dean knew what they were doing when they set a pair of big cylinders to turn one solitary pair of driving wheels—with a sand pipe in front of each! In bad weather, or on an oil-smothered club or exhibition track, a working sanding gear comes in mighty useful, and the following notes show a simple arrangement for "Maid" and "Minx." It is of the plain gravity-feed type; I could easily specify a steam sander, but the trouble is, they are *too* efficient! The first one I ever made and fitted, to a $2\frac{1}{2}$-in. gauge G.W.R. single-



Guard irons

wheeler, sanded the motion, driver, and passengers as well as the railheads. The reason was, that the velocity of the steam jets in the ejectors, necessary to exhaust the pipes and suck down the sand from the traps, was far greater than needed, merely to blow the sand under the wheels. Hence the "storm in the desert." The gravity sander, or "drop sander" as enginemen call

7/32 in. of the end, to 3/32 in. diameter, and screw 3/32 in. or 7-B.A. Next, turn down a bare $\frac{3}{8}$ in. length to $\frac{3}{16}$ in. diameter, a nice working fit in the reamed hole. Part off at 1 in. from the end; reverse in chuck, and file a square on the end, same as described for boiler fittings. Fit a handle to this, made from $\frac{1}{16}$-in. by $\frac{1}{4}$-in. steel strip, same as I have described



Sand boxes and valves

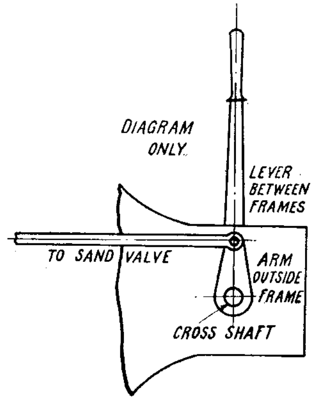
it, works quite well as long as the sand is quite dry and finely sifted; and only puts the sand where you want it.

Our "approved" advertisers will probably be able to supply castings for the sand-boxes, with the boss for the valve cast integral; both our Glasgow friend "Wilwau," and Mr. Haselgrove, have supplied me with sand-box castings for other engines. The angles for attachment to the underside of the running-boards will also be cast on. The boxes are left open at the top, the running-boards effectually preventing moisture getting in, and causing damp sand and clogged pipes. The sand-boxes could also be made from sheet brass of about 22-gauge; front, back, and bottom in one piece, with separate sides. The whole doings, complete with valve boss and pipe, could be silver-soldered up as one unit; a nice little exercise in "fabrication." Your humble servant would cut out a paper pattern of each piece, first of all, to get the right shape; the dressmaker of my childhood days, taught better than she knew!

Full-sized gravity sanders usually have a disc valve at the bottom of each sand-box, but in the small size, this is going to be a dickens of a job to fit and operate. I have, therefore, shown a simple plug-cock type of valve, same as adopted for my own $3\frac{1}{2}$-in. gauge "Grosvenor." Simply drill and ream a $\frac{3}{16}$-in. cross hole through the rectangular boss under the sand-box, and drill a vertical hole with $\frac{1}{8}$-in. drill, down the centre. Open out the underside, to take the 5/32-in. thin-walled sand pipe, which is silver-soldered in.

The plug is turned from a piece of $\frac{1}{4}$-in. round brass rod held in three-jaw. Turn down about

for piston-valve cylinder drain cocks and similar fitments. Put the plug in position in the valve body, with the handle pointing about 45 deg. to the back of the sand-box; then poke the $\frac{1}{8}$-in. drill down the hole, from the open top of the box, and make a countersink on the plug. Remove plug, drill the countersink No. 40, replace plug,



Sand lever

and tighten the nut just sufficiently to allow the plug easy movement. No grinding-in is, of course, needed; the sand would have to be mighty fine, to get out between the plug and valve! If the nut tends to work loose, slightly burr over the end of the screwed part of the plug.

The positions of the sand-boxes are shown in the general arrangement drawings and the full-sized blueprints, and they are attached to the underside of the running-board by two screws each side, through the angles or cast-on lugs, as shown in the illustration. The ends of the pipes should be filed off parallel with the rail, as shown, and should be approximately ¼ in. above it. In the old days of "Look Bill and See Charlie's Rabbits," we got up to all sorts of antics to prevent the sand being blown away from the rail when the weather was rough; a favourite trick was, to get a few inches of old washing-out hose, put it over the end of the pipe, and tie it in position with a piece of tar-band. The lower end of the hose rested on the rail, and an arch-shaped hole was cut in the side nearest the wheel, to allow the sand to remain on the rail. Lengths of discarded socks and stockings were often pressed into service. However, there is no need for any of those tricks on the little engine. The "Vulcan" pipes will clear the brake-gear on the "Minx," if left as shown; but the "Maid's" sand pipes will need a set in them to clear the blocks and hangers, same as on big sister.

The sand-box fillers are simply pieces of brass or copper tube, about ⅜ in. long, soldered into drilled holes in the running-board over the boxes. You can use ½-in. or ⅜-in. tube, as desired. If the former, use a press-in lid, made by turning a spigot about ¼ in. long on the end of a bit of ⅝-in. round rod held in three-jaw. Part off to leave a head about 3/32 in. thick, rechuck the other way around, and round off the edges. The snap-on lid can be made the same way; but before parting off, drill and D-bit it to fit over the top of the ⅜-in. tube. The sand-box lids on most of our engines were attached to the inside of the box by a loose chain, like the petrol-tank filler caps of many modern cars, including my own gasoline buggy. Incidentally, as I keep a can of dry sand in my car shed, as insurance against fire, I'll have to watch points in case I become absent-minded, and think I'm filling up the sand-boxes on old "Wigmore," or "Purley," or "Lullington"! The merry old 2-2-0 doesn't need any sand to climb a grade of 1 in 4 without slipping in bad weather, although her ratio of tractive effort to adhesive weight is far below any locomotive—which just goes to prove that adhesive weight alone isn't everything. The chains on the sand-box lids were a source of annoyance to the cleaner boys, who used the lids for pounding up the bath-brick with which they scoured the copper chimney tops, spring-balance casings, whistles, and other bright adornments. Also if a box lid jumped off and dangled by its chain when the engine was running, it didn't improve the personal appearance of the paintwork, in the case of a sand-box forming part of the splasher, as most of them did.

The sand-valves can be operated by an arrangement similar to the reversing-gear I described for the tank engine "P.V. Baker." A ¼-in. cross-shaft can be run through two holes drilled in the frames at the rear end (exact position doesn't matter an Assouan) with a small vertical arm at each end, the ends of which are connected to the sand-valves by thin rods running along close to the frame. A vertical hand-lever is attached to the shaft, so that it projects through the footplate, close to the right-hand seat box, on the opposite side to the reversing lever. The normal position is forward, when the sand-valves are closed; pulling it back, opens them, and the sand will then flow to the rails. On "Grosvenor," I use ordinary silver-sand sifted through a very fine mesh coffee strainer, and it runs as freely as water, or the sand in the old-fashioned hour-glass or egg-timer. Warning to amateur engine-drivers—if the engine slips, *always* shut the regulator before opening the sand-valves. In full size, failure to do this has resulted in a broken crank axle. One of our favourite tricks in bad weather when stopping with a heavy train, was to open the sand-valves just as the driving wheels were ceasing to turn, so that they came to rest on the sand. This entirely eliminated any slip when restarting. I recommend it to the drivers of present-day engines such as the Southern "spam cans," and the L.M.S. "Duchesses."

Epilogue

Well, I guess that is all there is to be said about our two "Southernettes". They have created plenty of interest, and there are many in hand, judging from the correspondence received, and the sales of castings and material reported by our "approved" advertisers. There are more "Minxes" than "Maids," chiefly owing to the smaller driving-wheels, greater power, and less labour required in building. Some builders have tackled the engine as a first attempt, and made a success of it; it amuses (and gratifies) your humble servant when a delighted first-timer writes and says, "I built so-and-so engine, and it not only goes, but does all you say!" That is what I try to aim at, in my instructions; you see, I build engines myself, and personal practical experience is something you cannot beat. The huge correspondence from disappointed builders of "paper designs" in the earlier days of these notes, told its own story; and old Curly certainly doesn't believe in putting some fantastic contraption on paper, and then blaming the unfortunate builder for its non-success, which frequently happened in the past. It would be interesting to find out how many 100 per cent. "L.B.S.C." engines are running on public park, fete, club and exhibition tracks today, and how many other engines incorporate the principles laid down in these notes.

At the time of writing, I have just had a sort-out of two big steamer trunks, full up with drawings of the various locomotives I have described since coming to my present home in September, 1930; and to be quite frank, I am wondering how on earth I have ever managed to scheme out the various engines, make the drawings, write the instructions, and (most important of all) guarantee the results. In addition, there have been as many as 80 letters per week—average—to attend to, and a bit of locomotive-building for myself; so I may perhaps be excused for feeling old and tired. The drawings are all scrapped now, as blueprints are being made, and will be available from our offices. So with the best of good wishes to all builders of the "Maid of Kent" and the "Minx," I take leave of them, and the next job is to finish off the tale of "Doris."

TUBE BENDING

by D. Nicholson

IN July 7th MODEL ENGINEER, Mr. J. W. Tomlinson says that to bend tubes over ⅜ in., they should be bent a little at a time with intermediate peenings with a hammer on the inside of bend to remove any ridges which may form. He does not say to what radius bends he refers.

There is no need for any hammer work whatever on bends up to 1 in. bore, neither is it necessary to make more than one bite at the job.

If sand loading is used, the length of pipe which represents the bend to be made is heated to about a bright cherry red, when seen in a dull light, and the pipe bent while it is red-hot. This applies to copper or steel pipe only, copper especially.

One heat only is required for pipes up to 1 in. bore by 18 or 16 gauge; the same gauges can also be bent in 1¼ in. bore with one heat, but the number of good bends may not be as great as is the case with bends up to 1 in. bore.

Wherever it is possible (and in most cases this can be done), it is better to use hard wood dressers to dress out the wrinkles which raise up in the throat or inside of the bend on 1¼ in. upward. The reference to one heat only, refers to one bend, say square or "U", or as known in the heating and domestic trades—a return bend. Square bends can be made easily up to 1 in. bore by the foregoing methods, and the return bend can be made up to ⅝ in. or ¾ in. bore with one heat only.

It is quite common to be pipe bending all day long, using the methods stated without making one faulty bend, and each bend only taking an average of about two or three minutes after the correct heat has been arrived at.

There is sometimes a slight variance in the quality of pipe and this often means that a different heat is required; it is, however, useless to get the pipe too hot.

When the pipe has been heated to the right heat, one or both ends of the pipe are brought towards the operator in a steady sweep and quickly, while the heat is in the right place, no time being wasted in getting the bend made as soon as possible after the right heat has been obtained.

Nice clean bends are the result of the methods stated, no filing or hammer work being necessary, and the bends need only be cleaned with a piece of emery cloth to remove the dirty surface left after heating; the square ones only taking a matter of half a minute each to make.

If one cares to try, he will find that it is a very easy job to bend copper tube in this way. The sand must, however, be perfectly dry and packed tight into the pipe, one common method being to tap the end which represents the bottom on the floor, jumping it up and down repeatedly and filling the pipe a bit at a time.

I never use wood plugs myself on pipes up to ¾ in., because it is easier to squeeze the end ½ in. of pipe flat in the vice.

Bends should not be attempted on a short piece of pipe, unless absolutely necessary; it is far better to have the pipe longer than actually required and cut off what is not required after the bend is made.

To withdraw a bending spring from inside a pipe, the correct method is to turn the end that is outside the pipe in whichever direction will tighten the respective coils one on to the other, thus lessening the diameter of spring and at the same time keeping a slight pull outwards on the spring. The spring will let go with a jump and will then be easily drawn out of the pipe.

Another thing to remember with spring bending is if more than one bend is to be made while the spring is in the pipe, start bending at one end and work away from the first bend, making sure that the spring is released from each bend in turn before the next is attempted; this is very necessary with pipes of say ½ in. to ¾ in. and 1 in. bore.

I don't know if springs are made for copper pipe measured on the outside diameter, but they are in common use up to 1 in. bore. Springs are used on lead pipe up to 2 in. bore, but I have no experience of bending copper pipe in these latter sizes with springs.

It will be found that when, say, a square bend is made, if the two ends are taken farther than necessary so as to form a "over" square bend and then each end pulled back a little until the bend is exactly square, the sides will open out slightly, leaving a better-looking bend. Similarly, when a spring is being used for bending, this practice helps to release the spring and make it easier to get it out of the pipe.

If too much hammering is done on the side of a bend with a spring inside, it is possible to indent the copper between two or more of the coils, thus locking the spring, and often in the case of large size pipes the spring or the bend (sometimes both), are spoilt. There is not much danger of this with the small sizes.

If easy bends or sweeps are required, it is not necessary to work the pipe hot, but it must be soft. Loading is not always necessary for easy bends, quite a lot of work being done without loading by avoiding sharp bends.

For bending machine work, half hard is the correct grade. Soft pipes collapse under the tools, unless loaded, and hard pipes kink.

I have added this latter item because it is quite easy to make up a pair of grooved rollers for bending small pipes; I have already done this, nothing elaborate being necessary, and should anyone care to try, he will no doubt be pleased with the results.

One other tip, always use as heavy a gauge as the circumstances allow if sharp bends are wanted. Thin-walled pipe is difficult to bend sharp with good results.

*Traction Engines not so Well Known

by Ronald H. Clark, A.M.I.Mech.E.

XVI—Edward Humphries & Co. Ltd., Pershore

Situated in an agricultural district, this firm in its early days was concerned mainly with agricultural implements, threshing machines and the humble portable, and it was only after 1890 that a number of tractions were turned out. A typical example is seen in Fig. 32. They were partly assembly jobs, as some of the fittings were bought from Aveling & Porter Ltd.; for example the feedpump and its eccentric are standard Aveling pattern. The makers described it as an improved traction engine having a jacketed cylinder, steel crankshaft, cast steel gears; differential on the third shaft, two speeds, winding-drum, etc.

The small sizes 5, 6, 7, 8 and 10 n.h.p., had single cylinders, whilst the larger powers of 10, 12 and 14 n.h.p., had duplex cylinders.

When first produced, a 10-n.h.p. engine was listed at £595; and there are several of these engines left in the South Midlands district.

XVII—Lampit & Co., Banbury

Competitors of Barrows & Stewart (see No. II) in the same town, and having made a good portable in 1867, these people made a small number of successful tractions, some of which are at work in the South Midlands today.

They are well-built engines utilising the 3-and-4-shaft principle, *viz.* 3-shaft in high gear and 4-shaft in low. This is arranged by putting a small extra shaft (the third shaft) and gearing almost above one end of the crankshaft, and is only in use when the engine is put into low gear. I need not remind the traction enthusiast that when this low gear is in action, the engine, becoming for the nonce a four-shaft machine, runs the opposite way, so that, unless one remembered that the back gear is now the foregear and vice versa, quiet fun might result!

All are of 6 n.h.p. having a single cylinder $7\frac{1}{2}$ in. × 10 in. working at 140 p.s.i. A differential is included, and also a winding drum and the usual supply of wire rope. All gears are of cast steel. Rear wheels are 5 ft. 6 in. diameter × 14 in. wide, the width of the front being 8 in.

XVIII—Mann & Charlesworth Ltd., Canning Works, Dewsbury Road, Leeds

Although existing for many years under the above title they later become "Mann's Patent Steam Cart & Wagon Co. Ltd." and produced an excellent steam wagon adapted for various trades and probably unique in that the firebox had the firehole in the offside.

But it was as "Mann & Charlesworth" that they made their traction engines, nearly all of 7 n.h.p. and having a single cylinder with a single eccentric reversing-gear. Briefly, this gear consists of a pulley-wheel (in this case the governor drive pulley) keyed to the crankshaft and having four lugs cast inside it. The single eccentric is mounted close to it, loose upon the shaft, and has four lugs to correspond with those inside the pulley. All lugs are connected by means of bell-crank levers, connecting-links and the necessary pins. A sliding sleeve connects the arms of the bell-crank levers and is made to slide along the

*Continued from page 223, "*M.E.*," *August* 18th, 1949.

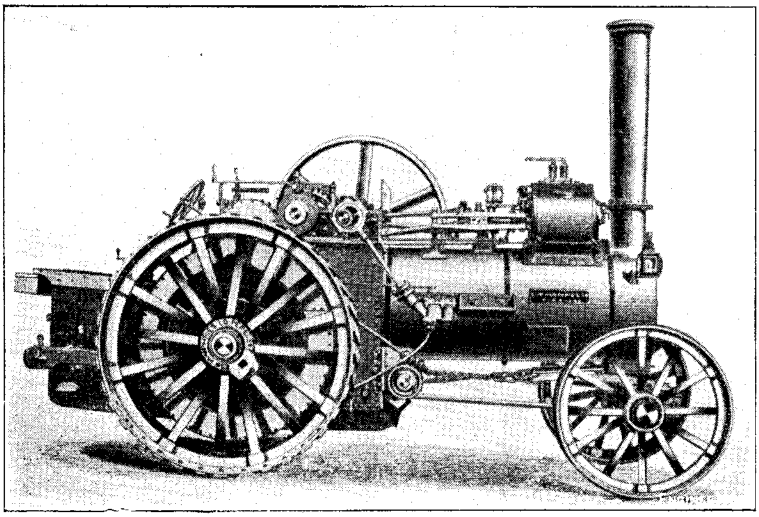


Fig. 32. General purpose traction engine by E. Humphries of Pershore

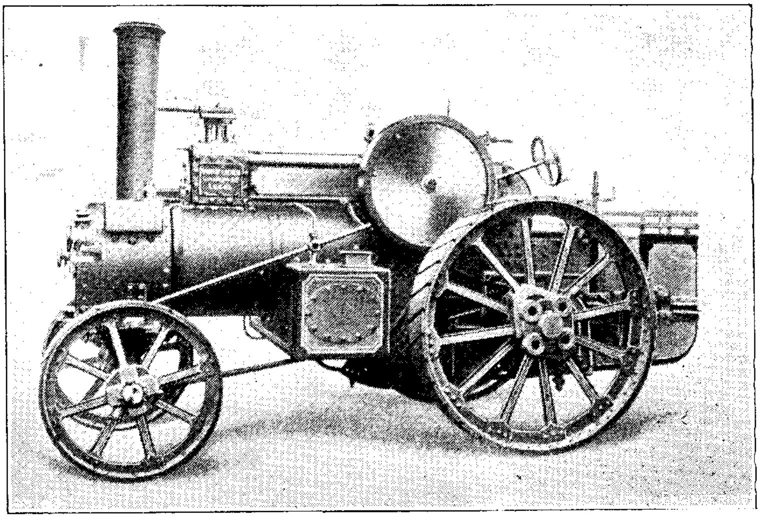


Fig. 34. *Mann & Charlesworth 5-ton light traction engine*

crankshaft by moving the hand lever provided for the purpose. In action, the motion is very similar to that of the familiar parallel ruler as, in any position, it is always parallel to the centre line of the engine, i.e. at right-angles to the crankshaft. The point of cut-off is altered by sliding the sleeve, by the hand lever, the required amount. In the mid-position, the travel of the eccentric is zero, increasing to the maximum in the other direction as the hand lever is moved right over.

In Fig. 33, we see a good example of their standard traction engine which, apart from this valve gear, is quite straightforward and typical of the '90s. There are one or two yet at work in odd places.

After the reconstruction to "Mann's Patent Steam Cart & Wagon Co. Ltd." a light type of steam motor tractor was made in goodly numbers in addition to the wagon, this tractor being under five tons unladen, and powered by either single or compound engines; an illustration is given in Fig. 34, showing one equipped for long-distance work and complete with belly-tanks and

Fig. 33. *Mann's single-cylinder engine*

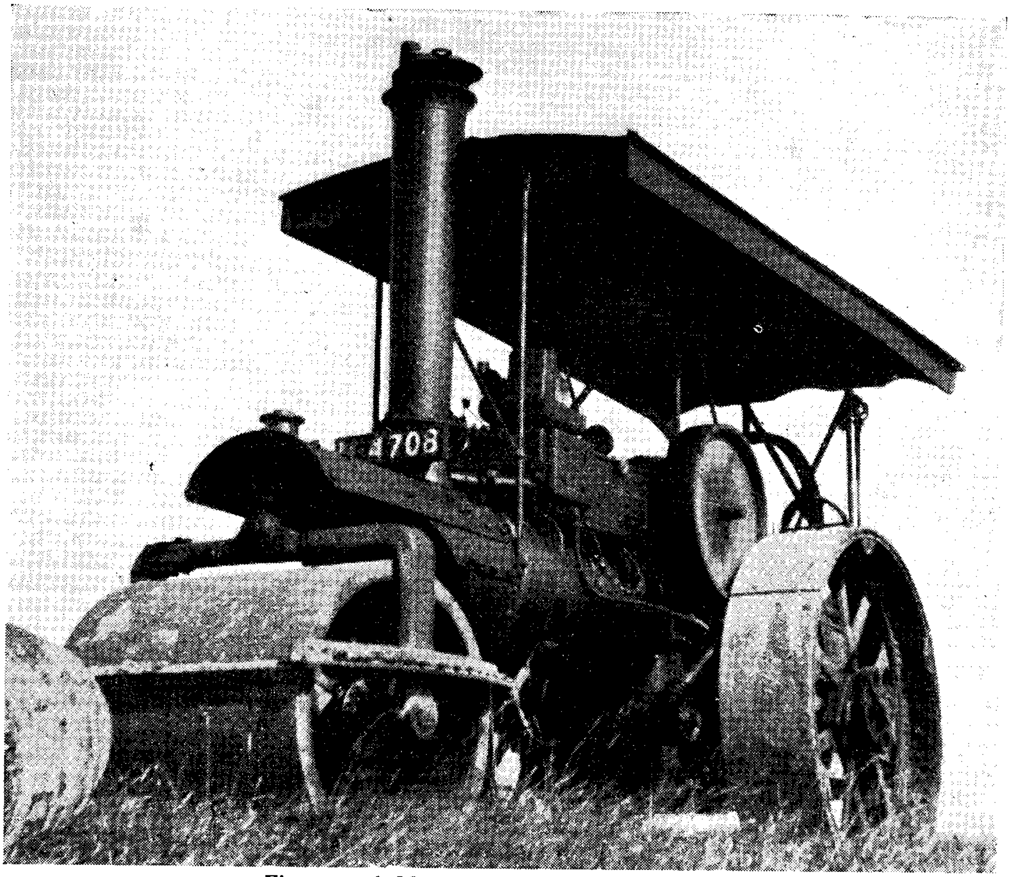


Fig. 35. A Mann tractor converted to a roller

direct worm-geared steering. They all worked at 200 p.s.i. and had disc flywheels.

These tractors are a favourite with steam-rolling contractors, and in Fig. 35 we see one converted to an 8-ton roller by fixing boiler plate over the strakes of the rear wheels and attaching a front saddle and rolls off any other make of roller available or spare at the time. That shown in Fig. 35 is in everyday use in Lincolnshire, is economical and works very silently. Note that a Mann tractor or roller can always be identified by the bosses of the rear wheels having four driving-pin holes, not one or two as found in other makes. Other main features are the high-pressure cylinder on the right-hand side as is the winding drum and the spring mounting of the rear axle.

XIX—Petters Ltd., Yeovil

Although now always associated with the oil and paraffin engine it is not generally known that this firm turned out about half-a-dozen steam tractors in the past. They were all rated at 5 n.h.p., had three shafts and a single cylinder.

They were light and handy engines, and one was reputed to have been at work in South Lincolnshire until during the first war.

(*To be continued*)

For the Bookshelf

Railway Pictorial and Locomotive Review. (Published and edited by G. H. Lake, 156, Camden High Street, London, N.W.1.) Price 2s. 6d.

The August-September issue of this popular magazine contains an informative and fascinating article by Mr. O. S. Nock, who deals with the work of "Three Generations of West Coast 4-6-0's"; these are, of course, "Claughtons," "Royal Scots" and "Converted Scots." The article is illustrated by some excellent photographs to which, however, one of an old "Claughton" might have been added to complete the selection. Among the other good things in this issue, particular mention should be made of the articles: "Sound Pictures of the Past," "Major Repairs to a Scottish Region Viaduct" and "The Wood Green-Langley Junction Line."

PRACTICAL LETTERS

Fine Feeds

DEAR SIR,—The article on the above subject by Mr. E. G. Smith is most interesting and, judging by the excellent photos, Mr. Smith has made a fine job of the machining of this cunning device.

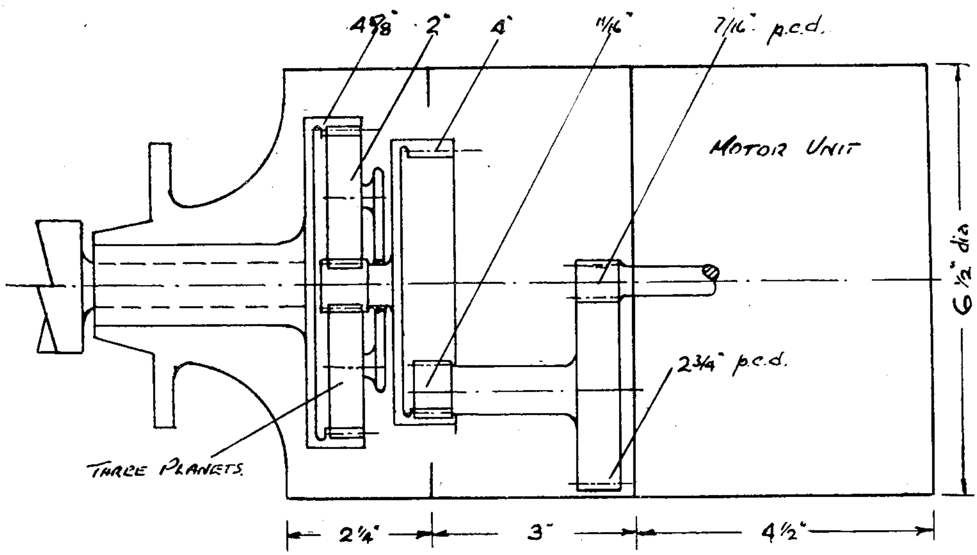
Personally, I was doubly interested; first, as a lathe user and, secondly, because I have recently stripped a surplus aero-engine electric starter of American make and found it to contain a very robust and precisely made epicyclic gear similar to, but considerably heavier than Mr. Smith's, and having an additional reduction train, the whole in steel.

It occurs to me that those who may consider building Mr. Smith's device, but cannot contemplate the gear cutting would find the components of this starter adaptable to the job, if the greater diameter can be accommodated.

For their information I give a sketch of the gear layout as found in the starter. Dimensions are only approximate, having been scaled by rule without dismantling the gear train. All members run like silk on ball-bearings and the design and construction are exemplary.

The total reduction through this gear is about 225 : 1 and, for those interested in such a ratio, the motor armature (a 24-volt d.c. job) lends itself to mechanical drive by slotting the shaft end through the end nut. Another feature of the unit is that the engine engaging claw is splined and sprung, and can be moved endways by means of a lever from the side of the 3 in. body; it also throws out again against a second heavier spring. The complete unit weighs some 20 odd lb.

There may be those who ask where they can purchase such a unit. If they will drop me a line c/o The Editor, I can put them in touch with a source and, although I do not know the price, believe it is very moderate.



Yours faithfully,

Bristol. W. D. ARNOT

An Old Pumping Engine

DEAR SIR,—With reference to Mr. Lewis's enquiry re Davey "Cataract" gear, he will find this gear illustrated on page 281 of D. K. Clark's "Steam and the Steam Engine," in a description of a differential compound pumping engine installed at the St. Helens waterworks.

A similar plant was installed at the Gainsborough (Lincs) waterworks until a few years ago, when I replaced it with electrically-driven centrifugal pumping plant.

If your correspondent is unable to locate this book and cares to write to me c/o the Editor, I shall be pleased to give him the information he requires, as I have a copy.

Yours faithfully,

Nottingham. W. B. REDFERN.

Transformer Design

DEAR SIR,—I thank Mr. Hatch for pointing out in his letter the correct method of ascertaining the average length of a turn on the secondary winding of a transformer. Referring to the auto-transformer, however, he has mis-read my remarks. I state that the current flowing in the common portion of the winding is equal to the difference between the current in the two windings, i.e. the primary and secondary. Now in Mr. Hatch's diagram the primary current is one amp and the secondary two amps, then 2 — 1 = 1 amp flowing through the common winding, which is what he shows.

Yours faithfully,

Banstead. A. R. TURPIN.